COLONY AND PROTECTORATE OF KENYA

DEPARTMENT OF AGRICULTURE ANNUAL REPORT 1948

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DEPARTMENT OF AGRICULTURE ANNUAL REPORT, 1948

PART I—AGRICULTURE IN 1948

WEATHER

The short rains of 1947 were considerably below average and as these were followed by the usual hot, dry weather of January and February the country was in a very dry condition by March. The long rains of 1948 broke in March and were generally below average, although adequate in most areas. Rainfall in the second half of the year was rather above average, but distribution was uneven particularly in the main coffee areas and at the coast. Taking the year as a whole the total rainfall was a little below average, but conditions were favourable in the main producing areas.

(*For the following detailed notes on weather conditions, together with Tables A and B, the Director of Agriculture is indebted to the Director of the East African Meteorological Department.*)

Rift.—Rainfall was slightly above average from June to October, but the other months were rather dry and the total for the year was some 7 per cent below average.

West Rift.—As in the Rift area January to March and November to December were dry; only June and October were wetter than usual and the annual total was 10 per cent below average.

East Rift.—July and October were the only months with rain much in excess of average, but the annual total was only 3 per cent below average.

Trans Nzoia.—The rains from June to October were above average, October being particularly wet, but shortfalls in other months resulted in an annual total just below average.

Nyanza.—Except for September, totals were above average from June to October, but rains were rather poor in the remaining months and the total for the year was 11 per cent below average.

Main Coffee Areas.—Rains up to September were very poor, but good "short rains" lasting until the end of December reduced the deficit for the year to 9 per cent.

Coast.—The total rainfall for the year was almost average, months of slight excesses alternating with wetter months throughout the year.

TABLE A

RAINFALL OVER THE MAIN AGRICULTURAL AREAS OF KENYA—1948

District / Number of Stations	Rift 23		West Rift 11		East Rift 20		Trans Nzoia 23		Nyanza 27		Main Coffee Areas 28		Coast 17	
	Mean Fall 1948	Ave. Fall	Mean Fall 1948	Ave. Fall	Mean Fall 1948	Ave. Fall	Mean Fall 1948	Ave. Fall	Mean Fall 1948	Ave. Fall	Mean Fall 1948	Ave. Fall	Mean Fall 1948	Ave. Fall
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
January	0·22	1·03	0·65	1·49	0·14	1·06	0·57	0·84	1·42	2·03	0·12	1·56	0·40	0·88
February	0·39	1·49	0·29	2·45	0·91	1·25	0·53	1·56	1·14	3·28	0·65	1·81	0·61	0·56
March	2·29	3·15	2·71	4·12	2·31	2·49	2·77	2·88	4·04	5·48	3·23	4·71	1·11	2·18
April	5·09	5·53	6·14	6·84	4·97	5·00	5·62	5·84	7·37	8·77	7·85	9·16	7·26	6·57
May	3·62	5·10	5·64	6·29	2·89	3·90	4·65	6·63	8·55	9·60	2·65	5·62	9·11	13·59
June	4·36	3·30	7·10	5·06	2·45	2·57	5·60	4·92	6·60	5·47	1·84	1·64	6·39	5·05
July	4·79	4·32	6·20	5·87	4·66	4·09	6·98	6·03	5·40	4·63	0·45	0·68	4·13	2·85
August	4·59	4·41	6·29	6·53	3·22	4·13	5·88	6·59	6·69	5·98	0·71	0·86	2·50	2·72
September	3·38	2·59	4·08	3·91	2·15	1·83	4·47	3·88	4·54	5·49	0·69	1·11	1·55	2·82
October	2·84	2·24	3·52	2·51	3·69	2·09	6·17	2·54	5·90	3·79	4·38	2·79	4·06	2·99
November	2·03	2·73	1·48	2·91	2·94	3·13	1·10	2·42	2·99	4·82	5·46	5·90	2·68	2·81
December	1·20	1·65	1·11	1·98	1·80	1·76	0·17	0·95	1·02	3·28	7·51	3·23	5·27	2·58
Year	34·80	37·54	45·21	49·96	32·13	33·30	44·51	45·08	55·66	62·62	35·54	39·07	45·07	45·60

TABLE B

PERCENTAGE DEPARTURES

	Rift	West Rift	East Rift	Trans Nzoia	Nyanza	Main Coffee Areas	Coast
January	—79	—56	—86	—32	—30	—92	—54
February	—73	—88	—26	—66	—65	—64	8
March	—27	—34	—7	—4	—26	—31	—49
April	—8	—10	—1	—4	—16	—14	10
May	—29	—10	—26	—30	—11	—53	—33
June	35	40	—5	14	20	12	26
July	12	6	14	16	17	—34	45
August	5	—4	—22	—11	13	—17	—8
September	31	4	18	15	17	—38	—45
October	27	40	77	143	56	57	36
November	—26	—49	—6	—54	—38	—7	—4
December	—27	—44	2	—82	—70	133	105
YEAR	—7	—10	—3	—1	—11	—9	—1

AGRICULTURAL EXPORTS IN 1948

The value of agricultural produce exported annually from Kenya continues to increase. The total value in 1948 was £8,783,398, an increase of 16 per cent over the figure of £7,589,578 for 1947.

The most important increases were in sisal and coffee. Sisal retained its place as the most valuable export commodity; the quantity exported increased by 26 per cent, but the value increased by 74 per cent. The quantity and value of coffee exported increased by 34 per cent and 54 per cent respectively. Other important increases were in hides and skins, particularly shade-dried goat and sheep skins, and in wattle bark and extract. Amongst minor crops a notable increase occurred in the export of sunflower seed, the value of the exports being £26,747.

On the other hand, setbacks occurred in the export of several important commodities. After increasing steadily for some years, bacon, ham and butter showed sharp declines. Export of maize dropped to the lowest since the war years, and the quantity of tea exported was the lowest since 1935, although its value was the highest for any year except 1947. Pyrethrum exports, which showed an enormous reduction in 1947, continued to decline and both quantity and value were the lowest since 1938.

Table C shows the quantities and values of major items of agricultural produce exported during the last four years together with corresponding figures for 1939, which provide interesting comparisons. In 1939 the ten most important items of produce exported were, in order of value, coffee, tea, sisal, pyrethrum, maize and maize meal, wattle bark and extract, cotton, hides and skins, and wheat and wheatmeal. Of the first four, three—sisal, coffee and tea—remain in the lead, joined by wattle bark and extract which have moved up from sixth place to third. Skins have moved up to fifth place, while pyrethrum has dropped to ninth. The total value of the exports of these ten commodities in 1948 was £7,613,995, an increase of 168 per cent over the 1939 figure of £2,844,871; yet the total quantity of these products is less now than ten years ago, only wattle bark and extract, skins, and wheat and wheatmeal showing increases of any importance.

CROPS

Barley.—There was a moderate increase in the acreage under barley and in the total yield although the yield per acre dropped from 5.5 bags (of 180 lb.) per acre in 1946–47 to 5.1 bags in 1947–48. Production in the latter year amounted to 50,735 bags from 9,732 acres compared with 44,924 bags from 8,162 acres in 1946–47. The price to the producer for malting barley was Sh. 27/25 per bag, an increase of Sh. 1/75 per bag over the previous year's price. Sixty per cent of the barley crop was retained on farms for feeding purposes.

Cashew Nuts.—The setback in production recorded last year was more than recovered in the 1947–48 season, the total sales by producers amounting to the record figure of 983½ tons compared with the previous highest figure of 752 tons in 1945–46. The price remained 10 cents per pound to the producers, who received £11,015 for the crop. Unfortunately seasonal conditions in 1948 were unfavourable, heavy rains during the flowering period reducing the setting of fruit, and the 1948–49 crop is expected to be considerably less than the previous one.

Cassava.—Food shortages in Nyanza Province during the first half of the year led to considerable use being made of stocks of cassava which were available, and there were widespread internal sales at high prices. The value of this crop as a famine reserve was thus emphasized, but it naturally followed that only greatly reduced quantities were disposed of to Control. Sales of dried cassava amounted to 1,948 bags (of 125 lb.) valued at £487 compared with 24,948 bags valued at £6,237 in 1947. Considerable acreages were planted during 1948.

TABLE

QUANTITIES AND VALUES OF CERTAIN AGRICULTURAL COMMODIT
1939 AND 194

Commodities	Unit	Quantity		
		1939	1945	1946
Animals Living:—				
Cattle	No.	—	—	—
Sheep and Goats	,,	—	538	1,210
Animal Products:—				
Bacon and Ham	Cwt.	1,376	2,954	4,654
Beeswax	,,	1,208	399	717
Butter	,,	19,331	14,402	23,472
Cheese	,,	652	213	499
Ghee	,,	1,946	2,305	1,257
Hides (shade dried)	,,	19,245	26,958	25,640
Hides (sun dried)	,,	21,737	8,037	8,515
Skins (Sheep and Goats) (shade dried)	No.	337,082	355,771	864,966
Skins (Sheep and Goats) (sun dried)	,,	1,014,543	499,977	810,539
Wool	Centals	15,114	22	6,690
Crop Produce:—				
Coco-nuts and Copra	Tons	215	40	41
Coffee	Cwt.	338,125	149,297	193,342
Cotton	Centals	59,677	16,053	6,537
Sisal	Tons	29,163	28,531	24,555
Flax	,,	16	646	589
Beans (including Soya beans)	Cwt.	123,002	30,327	53,020
Maize	,,	1,007,125	1,077,238	348,245
Maize Meal and Flour	,,	112,029	16,583	82,737
Pulses, other than Beans	,,	7,756	18,815	59,011
Wheat	,,	973	201,179	33,815
Wheat Flour	,,	63,883	120,010	192,676
Grain, other than Maize and Wheat	,,	14,618	110,458	126,590
Groundnuts	Tons	402	—	—
Linseed	,,	—	1	1
Cashew Nuts	,,	32	25	74
Sesame	,,	1,283	3	1
Sunflower Seed	,,	477	—	75
Coco-nut Oil	Imp. gal.	33,152	115	—
Essential Oils	,,	3,660	5,856	5,698
Groundnut Oil	,,	6,233	20	300
Sesame Oil	,,	89,944	40	106
Potatoes	Cwt.	173,046	117,920	95,511
Pyrethrum	,,	55,628	108,187	148,855
Sugar	,,	81,463	27,566	12,729
Tea	,,	88,627	85,052	79,920
Wattle Bark	,,	226,716	184,859	157,030
Wattle Extract	,,	131,312	171,163	238,923
Passion Fruit Juice	Imp. gal.	22,744	5,042	6,527
Other Agricultural Produce	—	—	—	—
Total £				

C

IES, THE PRODUCE OF KENYA, EXPORTED DURING THE YEARS 5 TO 1948

		Value				
1947	1948	1939	1945	1946	1947	1948
		£	£	£	£	£
21	—	—	—	—	74	—
864	742	—	477	1,022	801	676
6,592	4,391	9,080	25,852	40,058	64,031	45,140
590	638	5,162	3,362	9,078	9,320	9,109
28,539	18,735	82,797	98,402	153,988	273,735	224,970
898	814	2,987	1,170	3,102	6,614	7,787
142	4	7,862	18,458	9,550	846	26
21,980	34,476	53,372	114,474	157,738	277,696	290,802
9,810	10,567	43,444	20,678	49,317	67,927	67,975
1,392,149	2,120,957	18,152	32,940	98,571	211,655	425,899
1,051,632	829,181	40,900	28,749	73,226	118,100	103,802
9,089	8,940	56,578	168	30,156	41,846	91,714
56	31	1,561	124	645	586	338
213,814	287,644	800,827	639,433	950,179	1,311,633	2,018,573
14,549	9,056	124,021	104,805	40,685	99,472	96,688
24,283	30,639	442,434	769,494	858,830	1,360,883	2,365,717
128	56	810	72,486	75,801	14,504	8,703
29,750	40,548	40,250	27,533	80,544	45,378	55,518
1,248,802	272,152	222,037	458,294	155,796	671,730	176,780
114,377	125,416	25,450	7,207	37,275	76,760	127,374
176,208	85,887	2,702	26,130	112,121	363,084	167,038
328,242	128,125	393	166,319	27,351	285,449	143,157
166,088	177,239	50,655	153,950	233,205	216,314	273,969
70,702	114,162	4,424	97,532	121,360	50,815	91,211
—	65	4,442	—	9	2	2,060
5	—	5	14	17	319	—
59	69	1,812	7,534	22,513	13,952	13,549
—	—	14,499	84	20	3	—
86	828	3,997	1	1,043	1,829	26,747
1,012	411	2,346	29	—	257	103
5,671	4,100	4,956	17,074	21,332	17,675	7,270
64	75	680	8	78	17	24
758	884	10,008	14	28	207	276
54,898	33,762	29,199	62,007	46,549	29,681	20,008
34,583	29,395	357,170	792,895	1,156,402	271,999	188,622
29,053	10,754	50,308	27,521	14,464	31,621	12,683
85,588	53,089	501,732	532,447	534,240	907,079	642,484
205,007	229,560	72,846	89,448	78,135	132,924	191,073
231,789	254,710	91,438	165,103	253,350	313,685	501,080
9,511	29,432	6,713	1,685	2,233	4,366	13,763
—	—	54,446	156,314	172,117	294,799	370,690
		3,242,475	4,720,215	5,622,128	7,589,578	8,783,398

Chillies.—Chillies are the main cash crop of part of Voi district and in 1948 production amounted to 6,831 frasilas (of 36 lb.). The average price to the producer was Sh. 26 per frasila.

Coffee.—A further substantial increase in coffee production is to be recorded, but the recovery has not yet been enough to bring exports up to the average of pre-war years. For the 1947–48 season the registered European acreage under coffee was 64,261 acres compared with 64,392 acres in the previous season. Production amounted to 14,075 tons valued at £2,197,137 compared with 9,043 tons valued at £1,028,245 in 1946–47. The average pay-out to growers was Sh. 148/77 per cwt. compared with Sh. 111/68 in 1946–47 and has increased by nearly 60 per cent in three years. Interest in coffee growing by Africans in Central Province continued to increase, particularly in Meru district where very satisfactory results have been achieved. The area under coffee in the province increased from 241 acres (867 growers) in 1947 to 342 acres (1,222 growers) in 1948. Sales increased in value from £2,605 in 1947 to £4,121 in 1948. The crop in Kisii district suffered a set-back by a change in organization and little interest was shown; the value of production fell from £3,701 in 1947 to £2,596 in 1948.

Copra.—A further fall in production took place in 1948, the total amount of copra sold to the Control amounting to only 45,920 frasilas (of 36 lb.), valued at £21,300, compared with 80,890 frasilas in 1947. The price remained the same, an average of Sh. 9/40 per frasila. The drop in production can be largely attributed to poor seasonal conditions, but apart from this there is little enthusiasm at the coast for copra production, a large proportion of the coco-nut crop being used as food.

Cotton.—There was a small decrease in cotton production in both Coast and Nyanza Provinces, the total yield amounting to 4,863 bales (of 400 lb.) of lint in the 1947–48 season compared with 5,148 bales in 1946–47. Little interest was shown in the crop, which in Nyanza suffered severely in its early stages from excessive rainfall and insect damage; better conditions later in the season enabled the quality to improve. Prices for seed cotton remained the same as in the previous season, 21 cents per pound in Nyanza and 22 cents at the coast for first quality. A sharp advance in price was decided on for the 1948–49 season and wide publicity about this, coupled with a strong desire to reinstate this crop in the important position it used to hold in Nyanza, led to a great revival in interest. Considerable increases in production in both areas are forecast.

Essential Oils.—The decline in the value of essential oils, noted in last year's report, continued and as a result there has been a sharp decline in production. Exports in 1948, four-fifths of which were of cedar wood oil, amounted to only 4,100 gallons valued at £7,270 compared with 5,671 gallons valued at £17,675 in 1947. The value of essential oils as a whole has declined from Sh. 75 to Sh. 35 per gallon since 1946. There is, however, a very wide variation in the values of different oils, geranium oil being 13 times as valuable as cedar wood oil.

Flax.—Flax production is now confined to two small areas in Uasin Gishu and Molo and plantings in 1947 were approximately the same (700 acres) as in 1946. Production in the 1947–48 season amounted to 59 tons of fibre and 35 tons of tow compared with 65 and 40 tons respectively in the previous season. The value of the 56 tons of fibre exported during 1948 was £155 per ton f.o.b. Mombasa; prices for the various grades ranged from £218 to £153 c.i.f. French ports where most of the fibre was sold. A spinning plant has been started on the slopes of Mount Elgon and this is likely to absorb most of the future production of flax.

Groundnuts.—Increasing interest was shown in groundnuts in Nyanza Province as a food crop; the acreage was larger than in 1947 and the season was favourable. Sales to Produce Control showed only a slight increase, however, amounting to 17,285 bags (of 180 lb.) in 1948 compared with 13,292 bags in 1947.

Kapok.—The stimulus provided by the price increase in 1947 was short lived and in spite of the maintenance of the producer's price at 30 cents per pound only 33,397 lb. of kapok were bought in the 1947–48 season compared with 50,000 lb. in 1946–47. Further tree planting has been encouraged and the price has been increased for the 1948–49 season.

Linseed.—There was a considerable increase in the area under this crop in 1948, 7,413 acres being sown compared with 372 acres in 1947. Yields in the higher areas were between four and five bags (of 200 lb.) per acre. The guaranteed price to the producer remained at Sh. 84 per bag. As linseed needs a fine seed-bed and sowing time coincides with the heaviest rain there is considerable danger of soil erosion and for this reason no great expansion in acreage is expected in the future.

Maize.—The 1947 non-native crop yielded 719,459 bags (of 200 lb.) from 110,887 acres together with 74,813 bags of squatter maize. The acreage showed a slight increase over 1946 sowings, but production was 10 per cent lower, the yield per acre falling from 7.1 to 6.65 bags. Both the main producing areas, however, enjoyed favourable seasons and the average yields were 8.97 bags per acre in Nakuru district and 7.17 bags in Trans Nzoia district. Yields were greatly depressed in some of the other districts by either waterlogging or drought. Of the total production, 314,758 bags were retained on the farms for labour rations and stock feed.

The poor seasons in 1947 in Nyanza Province led to some shortage of food early in 1948. This resulted in a serious reduction in exports from the province and to great planting activity in the 1948 long rains. This crop yielded well and the situation rapidly improved. In Central Province, on the other hand, although the 1947 short rains crops were poor, grain stores were still full and the excellent promise of the 1948 long rains led to an unusually large amount of surplus grain being placed on the market. The guaranteed free on rail price to non-native growers under the Increased Production of Crops Ordinance was originally fixed at Sh. 17/50 per bag in respect of 1947 plantings, but this was increased in November, 1947, to Sh. 20. Payments for native-grown maize were made on the same basis, but amounts varying from Sh. 3/40 to Sh. 5 were deducted from the price and paid into Agricultural Betterment Funds for the benefit of the producing districts.

Deliveries to the Control during 1947–48 were as follows:—

Non-native	395,471 bags	(1946–47: 511,767 bags)
Native (Nyanza) ..	350,109 bags	(1946–47: 1,132,265 bags)
Native (Central) ..	271,677 bags	
Other maize ..	46,408 bags	
Total ..	1,063,665 bags	

As nearly all the deliveries of native-grown maize to the Control in 1946–47 were from Nyanza, marked features of the year under review were the great reduction in the Nyanza crop and the unusually substantial deliveries from Central Province, where most of the maize-producing areas enjoyed favourable seasons.

The marked drop in total deliveries to Control was reflected in reduced exports. In 1948 only 19,878 tons of maize and maize meal valued at £304,154 were exported from Kenya to all destinations compared with 68,159 tons in 1947.

Oats.—There was a substantial increase in the area sown with oats in 1947–48. Production amounted to 32,823 bags (of 150 lb.) from 7,700 acres compared with 28,275 bags from 5,175 acres in 1946–47. The yield per acre dropped from 5.5 bags to 4.26 bags; 35 per cent of the acreage was, however, in Nakuru district where the average yield was 5.3 bags per acre. Three-fifths of the total

production was retained on farms for stock feed. The Kenya Farmers' Association (Co-operative), Limited, selling prices under the Increased Production of Crops Ordinance were fixed at Sh. 19 per bag for best milling oats and Sh. 15/50 per bag for best feeding oats.

The acreage sown in 1948 was nearly double that of the previous season.

Other Cereals.—The following quantities of other cereals were bought by Control from native areas during 1948:—

Sorghum (*M'tama*)	14,280 bags (200 lb.)	(1947: 13,675 bags)
Millet, Finger (*Wimbe*) ..	16,668 bags (200 lb.)	(1947: 30,385 bags)
Millet, Bulrush and Foxtail	48,025 bags (200 lb.)	(1947: 21,672 bags)

All the sorghum and finger millet was produced in Nyanza Province, where there was a general drop in all cereal production. The bulrush and foxtail millets are grown in Central Province and the big increase in the sales of these crops is noteworthy, particularly when the substantial increase in maize sales from this province is remembered.

Papain.—Interest in papain production is not so keen in Kenya as in Tanganyika Territory, but 43 cwt. valued at £3,799 were produced and exported in 1948. The export value was Sh. 15/80 per pound.

Passion Fruit.—During 1947–48 the number of licensed growers increased from 25 to 31 with a total area of 1,102 acres under vines of which 552 acres were in full bearing. Production during the same period amounted to 25,118 gallons of juice, showing a very substantial increase over the previous year's production of 10,346 gallons. A further increase in production is expected in 1948–49. The net pay-out to producers rose again, from 9.9 cents per pound of fruit to 11.3 cents, the levy remaining at 20 cents per gallon. Local consumption dropped, amounting to only 1,072 gallons compared with 1,487 gallons in 1946–47.

Exports during the year 1948 amounted to 29,432 gallons valued at £13,763 compared with 9,511 gallons valued at £4,366 in 1947. The export value rose slightly from Sh. 9/18 to Sh. 9/35 per gallon.

Potatoes.—The Defence (Control of Potato Sales) Regulations, 1945, were revoked at the beginning of March. Up to that time the Control had bought 594 tons of potatoes from native growers and 103 tons from non-native. During the year, 1,688 tons valued at £20,008 were exported from the Colony, of which 281½ tons were shipped as ships' stores.

The main source of supply of potatoes is Central Province. Yields were fair but blight was still the limiting factor. After the removal of control prices soared rapidly but soon settled down to a fair level. Some 5,500 tons valued at over £67,300 were sold out of the province. Other native areas produce smaller supplies for local markets. European production is inconsiderable and confined largely to seed potatoes.

Pulses.—Production of beans and other pulses fell off again in Central Province, but they are still one of the important sources of income to the producer. Sales out of the province amounted to 6,800 tons valued at £132,256 compared with 9,500 tons valued at £195,000. Fair crops of pulses were secured in Nyanza Province, but these were mostly consumed locally; sales out of the province amounted to only 624 tons valued at £11,760. Deliveries to Control from all areas during the year amounted to 2,383 tons of beans, 431 tons of field peas and 3,121 tons of cowpeas, green gram and other legumes.

Pyrethrum.—The war-time contract by which the entire exportable surplus of East African pyrethrum had been bought by the United Kingdom Government ended on 31st December, 1947. Unsold stocks amounting to some 4,700 tons were then in hand. In the light of this, the reduced price of £128 per ton f.o.b. Mombasa and the completely stagnant overseas markets, many growers had gone out of production by the end of 1947 and the licensed area under

pyrethrum was reduced from 47,398 acres in 1947 to 23,616 acres, probably not all of which was actually planted. Deliveries of dried flowers to the Agency amounted to 1,507 tons compared with 4,009 tons in 1947, and exports during the year amounted to 1,470 tons valued at £188,622.

By the middle of the year the market substantially improved owing partly to the working off of stocks and partly to the development of new uses for pyrethrum. A new price was fixed at £153 per ton f.o.b. on the basis of 1.3 per cent pyrethrins which it is estimated will enable the price to growers to be raised from 90 cents to Sh. 1/20 per pound of flowers. It is now likely that owing to the drastic reduction in production over the last two years Kenya production is unlikely to be able to meet the increasing demand of the next few years. Every effort is being made therefore to restore production to its previous high level.

Bud disease, *Ramularia bellunensis*, which had caused heavy losses in 1947 continued to be widespread, but not serious apart from one severe attack in North Kinangop.

Rice.—Conditions were favourable in the main producing areas of Nyanza Province where some 42,000 bags of paddy were harvested from 7,000 acres. Three-quarters of this crop were sold to local mills. Interest was small in other areas of the province where poor rains led to early drying out of swamps. This was experienced also at the coast where, however, good crops were reaped from a reduced acreage and were all consumed locally. Produce Control purchases amounted to 14,192 bags (of 220 lb.) of hulled rice.

Sesame.—A rise in price stimulated some interest in sesame after many years of neglect, but a shortage of seed and unfavourable growing conditions prevented much increase in production. Produce Control purchased 918 bags (of 180 lb.) in 1948 compared with 900 bags in 1947. All the scanty production at the coast was consumed locally.

Sisal.—In spite of the increased price and the easier labour position the estimate in last year's report of 30,000 acres of new planting in 1948 proved to be too optimistic. In the event only 3,585 acres of new land were planted together with 5,293 acres of replanting on old land. These new plantings brought the total acreage under sisal by the end of the year to 226,146 acres (1947: 217,268 acres) of which 182,452 acres were mature.

The total area over which cutting took place during the year amounted to 96,358 acres and production amounted to 34,699 tons. Exports amounted to 30,639 tons valued at £2,365,717 compared with 24,283 tons valued at £1,360,883 in 1947.

Sugar.—Production for the 12 months ending 30th November, 1948, amounted to 12,784 tons of refined sugar compared with 9,171 tons in the previous 12 months, and only 5,760 tons in 1946. This substantial increase over the last two years is due largely to increased plantings, but also to favourable weather conditions and the easing of the labour situation. No further increase can be looked for next year, however, as the acreage for the 1949 season is estimated at 13,214 acres which is very slightly below last year's corresponding estimate of 13,289 acres. Bulk exports of unrefined sugar and of jaggery amounted to 1,267 tons valued at £33,265.

Sunflower.—Interest in this crop for oil seed production increased rapidly owing to the encouraging price of Sh. 26/75 per bag (of 100 lb.) to the grower. The area sown in 1948 amounted to 13,569 acres compared with 3,231 acres in 1947 and 828 tons of seed valued at £26,747 was exported compared with 86 tons valued at £1,829 in 1947.

Tea.—After the high yields of 1947 which amounted to 13,384,000 lb. tea production received a serious set-back and amounted to only 10,200,000 lb. This drop was largely due to the poor weather conditions in the main producing areas; the dry weather at the end of 1947 was prolonged until May, 1948; then

the persistence of hail and cold weather throughout the rainy season until December continued the adverse effect on the crop. Another factor causing a drop in production was an attempt to return to pre-war standards of pruning and plucking. It is hoped that this will have beneficial effects in 1949. Exports during 1948 amounted to 5,945,968 lb. valued at £642,484 compared with 9,585,856 lb. valued at £907,079 in 1947.

Since the withdrawal of East Africa from the International Tea Restriction Scheme licences for some 30,000 acres of new planting have been issued in Kenya. This development is being handicapped by shortage of seed supplies. The total area under tea at the end of 1948 is estimated at 17,100 acres, of which 15,000 acres are mature gardens.

Tobacco.—The 1946 short rains tobacco season in Central Province was very successful and yields generally were above average. 931,024 lb. of green leaf were produced for flue-curing from 227 acres and the crops from the following long rains (1948) amounted to 751,529 lb. from 217 acres. Growers received a total of £4,052 for their leaf. This production showed an increase of 42 per cent over the figures for the previous year.

Native-cured tobacco gave estimated returns of £18,200 to Central Province growers. The Lamu crop amounted to 35,840 lb. of second and third grade tobacco for which the growers received £1,695; this tobacco was exported to Somalia.

Vegetables.—Vegetable production in the Teita Hills was retarded in the early part of the year by prolonged dry weather, but the production for the year increased by 100 tons over 1947 to a total of 800 tons valued at £8,000 to the grower. Large-scale production for which there is little or no organized marketing continued in Central Province.

Wattle.—Wattle bark prices rose again during the year and production increased over that of 1947 but did not reach the high 1946 figure. A total of 534,680 cwt. of bark was sold for which the producers received £268,787 compared with £187,158 for 518,300 cwt. in 1947. In addition to the value of the bark, growers receive very considerable revenue from poles, fuel and charcoal.

Exports from the Colony amounted to 229,560 cwt. of bark valued at £191,073 and 254,710 cwt. of extract valued at £501,080. Corresponding figures for 1947 were 205,007 cwt. of bark (£132,924) and 231,799 cwt. of extract (£313,685).

There has been a rapid increase in acreage in Uasin Gishu district where European growers now have 29,037 acres under wattle. Deliveries of bark to the new Eldoret factory have already started.

Wheat.—The 1947–48 wheat season in the main producing areas was poor climatically and resulted in a considerable drop in production. The average yield—3.6 bags per acre—was the lowest since 1944–45. The non-native crop produced 697,021 bags (of 200 lb.) from 193,463 acres compared with 818,102 bags from 194,936 acres in 1946–47. Production in Meru remained about the same as in recent years, but much more is being consumed locally and sales were negligible. Nyanza Province sold 1,280 bags to Control, but also consumed a great deal locally.

Acreages under wheat showed a considerable increase in 1948, particularly in Laikipia–Naivasha; the 1948–49 season was very promising and production is expected to beat all previous records.

Exports of wheat and wheat flour from the Colony during 1948 amounted to 15,268 tons valued at £417,126 compared with 24,717 tons valued at £501,763 in 1947.

LIVESTOCK PRODUCTS

Bacon and Lard.—Deliveries of pigs to bacon factories during 1948 comprised 19,806 baconers and 2,093 larders compared with 22,723 baconers and 2,903 larders in 1947. Exports of bacon and ham during the year amounted to

4,391 cwt. valued at £45,140 compared with 6,592 cwt. valued at £64,031 in the previous year.

Butter.—Butter production during the 1947–48 season fell back from the high figure of the previous year (6,336,030 lb.) to that of 1945–46 owing to low production of butter fat during the long dry period in early 1948. Of the 5,726,000 lb. of butter manufactured in creameries, slightly over 10 per cent was tinned. The pay-out for first grade butter fat during the second half of 1947 was Sh. 1/65 per pound, but this rose in March, 1948, to Sh. 2 per pound. The additional pool-payment also rose from 4½ per cent to 6½ per cent on the total butter fat received which included milk for cheese.

Civilian consumption of butter during the year 1947–48 remained constant and amounted to 22,900 cwt. Reduced production was reflected in the exports which during the calendar year 1948 amounted to only 18,735 cwt. valued at £224,970 compared with 28,539 cwt. valued at £273,735 in 1947.

Cheese.—Cheese production increased from 409,500 lb. in 1946–47 to 438,800 lb. in 1947–48. This was all manufactured at the Naivasha creamery. Exports in 1948 amounted to 814 cwt. valued at £7,787 compared with 898 cwt. valued at £6,614 in 1947.

Clarified Butter.—There was a marked decrease in the amount of clarified butter produced from native sources, from 1,157,148 lb. in 1946–47 to 627,444 lb. in 1947–48. Non-native production rose slightly from 82,718 lb. to 86,137 lb. during the same period. Exports were negligible.

Eggs.—Controlled marketing of eggs continued in Nyanza Province. Sales there amounted to 407,150 dozen valued at £24,428 compared with 303,162 dozen valued at £13,829 in 1947. Recorded sales in Central Province dropped from 717,910 dozen in 1947 to 468,042 dozen, but considerable unrecorded sales also took place.

Hides and Skins.—Exports during the year were:—

	Cwt.	*Value* £
Hides (shade dried)	34,476	290,802
Hides (sun dried)	10,567	67,975
	Number	*Value* £
Skins (shade dried)	2,120,957	425,899
Skins (sun dried)	829,181	103,802

The quantity of shade-dried hides exported increased by 57 per cent compared with 1947; more sun-dried hides also were exported, but the unit value of both types of hide dropped to such an extent that the total value of hide exports rose by less than 4 per cent. On the other hand, while the quantity of shade-dried skins increased by 52 per cent compared with 1947, the unit value also increased by 33 per cent, so that the total value of such exports more than doubled. Exports of sun-dried skins were slightly down in quantity and value.

Poultry.—Sales of poultry rose in both number and value in Nyanza and Central Provinces, from a total of 343,871 head valued at £40,756 in 1947 to 388,347 head valued at £55,067. Over 90 per cent of these sales was from Central Province.

Slaughter Stock.—The following are the figures of livestock bought for slaughter by the Meat Marketing Board during the years 1947 and 1948:—

	Non-native		*Native*	
	1947	*1948*	*1947*	*1948*
Cattle (including calves) ..	24,122	22,768	29,987	44,528
Sheep (including lambs) ..	29,038	22,851	99,008	127,722

Deliveries of porkers to butchers in 1948 amounted to 9,633 head.

Exports of live animals, chiefly for food, amounted to 742 head of sheep and goats valued at £676; 18,244 cwt. of meat and preparations thereof valued at £164,015 were exported, chiefly for ships' stores.

Wool.—The quantity exported in 1948 was 8,940 centals (of 100 lb.) valued at £91,714. The quantity was nearly the same as in 1947, but the value more than doubled as the unit value rose from £4 12s. to £10 5s. per cental.

Livestock, General.—The following figures show the estimated livestock population at the end of 1948:—

European Farms	*Number*
Cattle, pedigree	5,500
Cattle, grade and native	538,800
Sheep	231,500
Pigs	35,000
Poultry	236,000
Native Areas	
Cattle	4,500,000
Sheep and Goats	6,000,000

PRODUCTION IN NATIVE AREAS

In both Nyanza and Central Provinces the 1947 short rains were on the whole poor, particularly in the former. Crops were poor and food supplies were reduced, but except for parts of Nyanza the food situation gave no cause for anxiety; it did, however, stimulate planting in the 1948 long rains, and as these came early in Central Province some planting was carried out even before the end of February. Planting was also stimulated in Nyanza, but unfortunately there the long rains were late in breaking. In both provinces the season as a whole was good, but whereas in Central Province the favourable weather and the carry-over of food stocks from 1947 led growers to market an increased amount of cereals, in Nyanza Province a conservative policy was adopted and exports from the province were considerably reduced. Again in the short rain season Central Province was more favoured than Nyanza, the lower area millet crops in the former being particularly good.

Only in the coastal strips and the Teita Hills did Coast Province receive satisfactory rains and harvests were generally poor in consequence. Following the low production of 1947 this meant that the food shortages forecast in last year's report became serious and over 60,000 bags of maize meal had to be imported. Conditions were favourable in most of the native areas of Rift Valley Province and fair or good crops were secured in all but the lowest lands which border on the desert. Even so, production barely suffices for internal food requirements and little or no surplus is available for export from the districts.

Table D gives figures of quantities and values of the more important commodities marketed in Nyanza, Central and Coast Provinces. These represent only the surplus marketed after local requirements are satisfied, and in most cases the quantities shown are only a small fraction of the total production. Where a crop is subject to organized marketing, either through controls as with maize and some other produce or through factories as with cotton and wattle bark, it is possible to record such marketable surpluses accurately, but with many native crops it is possible only to estimate production and sales.

Provincial details of weather conditions and production and comparisons of the latter with 1947 are included in the reports of Senior Agricultural Officers in charge of the provinces; these reports will be found in Part III.

TABLE D

PRODUCTION IN NATIVE AREAS—1948

QUANTITIES AND VALUES OF MORE IMPORTANT PRODUCTS MARKETED (PARTLY ESTIMATED)

	Unit	Nyanza Province		Central Province		Coast Province	
		Quantity	Value	Quantity	Value	Quantity	Value
			£		£		£
Maize and Maize Meal	200 lb.	446,468	252,611	203,346	132,446	—	—
Millets and Sorghum	200 „	29,559	20,052	35,087	30,303	—	—
Wheat	200 „	1,250	1,812	298	358	—	—
Rice (Paddy)	150 „	16,177	15,529	—	—	22,400	42,000
Pulses	200 „	6,990	11,760	76,149	132,256	—	—
Potatoes	180 „	2,852	1,426	68,658	67,326	—	—
Cashew Nuts	Cwt.	—	—	—	—	19,670	11,000
Cassava	125 lb.	1,948	487	—	—	—	—
Chillies	Cwt.	—	—	—	—	2,196	7,800
Coffee (parchment and mbuni)	„	509	2,596	1,311	4,121	—	—
Cotton (Seed Cotton)	100 lb.	48,969	50,685	—	—	15,860	15,300
Copra	Tons	—	—	—	—	734	21,300
Groundnuts	180 lb.	17,289	23,340	—	—	—	—
Sesame	180 „	902	1,217	—	—	1,000	2,000
Tobacco, Green Leaf	Cwt.	—	—	14,714	4,052	—	—
Tobacco, Native Cured	„	—	—	2,621	18,199	303	1,700
Vegetables, Flowers and Fruit	—	—	12,000	—	154,600	—	38,000
Wattle Bark	Tons	910	5,688	26,734	258,787	—	—
Ghee	36 lb.	22,295	56,119	148	431	—	—
Eggs	Gross	33,929	24,428	39,004	25,300	—	—
Poultry	Dozen	2,572	4,444	29,791	50,623	—	—
Fuel, Poles, Charcoal	—	—	14,420	—	70,209	—	—

PART II—POLICY AND THE WORK OF THE DEPARTMENT OF AGRICULTURE

GENERAL

Whilst steady and encouraging progress can be reported from areas in both native and non-native land units it is a fact, and a fact which cannot and must not be lightly dismissed, that the overall general farming picture is one of land deterioration and not of land rehabilitation. This is an unpalatable statement, but one which has been repeated in this department's annual reports over a period of years and one which it is my duty to repeat again until steps are taken by every inhabitant in the Colony, irrespective of race or creed, to rectify the position. The task is great, but can be achieved by the wholehearted co-operation and goodwill of the farming community. The present position arises from—

(*a*) under-capitalization of the agricultural industry;
(*b*) shortages since the termination of hostilities of certain essential farm equipment;
(*c*) the need for the continued production of the maximum quantity of cereals;
(*d*) the complex problem of land tenure in the African land units;
(*e*) lack of vital research and experimental data.

Under-capitalization of agriculture has for centuries been responsible for retarding agricultural progress throughout the world and is likely to continue to be one of the most serious deterrent factors to development. Nevertheless, it is essential that in a developing Colony such as this ways and means be found to relieve the agriculturalist of direct taxation to the greatest possible degree and to ensure that such relief that may be given is put back into the development of the land. The usual form of agricultural financial assistance by way of loans, whilst essential in some cases, must be considered a palliative and not a cure; some sounder and more concrete method must be devised of giving relief if optimum productivity is to be attained.

Little can be done now to overcome the setback that agriculture has experienced through lack of essential equipment during the past few years. The causes are a *fait accompli* but the effect has been great.

The most serious cause of land deterioration is undoubtedly the continued policy for the maximum production of cereal foodstuffs. Each additional year this policy is continued must have disastrous effects on the land in both European and African areas. Should an immediate change of policy be introduced it is true that in bad climatic years the Colony might be unable to meet its internal requirements for cereals, but if the present policy is continued it is equally true to say that in a few years' time we shall be unable to meet those requirements in good as well as in bad years so serious is the rate of loss of soil fertility in many areas. Storage facilities will considerably ease the situation, but with the improved world cereal position consideration should be given to the advisability of subsidizing imported foodstuffs rather than subsidizing their production locally on soils of low fertility. With an immediate change-over to rotational farming throughout the Colony there will inevitably be a reduction in cereal production for several years to come, but eventually, by increased yields on a smaller acreage, the position will readjust itself. It is essential that the long-range policy be adopted at once; each year's delay means a much longer period before final stability will be reached.

In the African land units fragmentation of land is one of the most serious deterrents to a sound agricultural policy. Progress is being made by the introduction of group farms and smallholdings, but rapid acceleration of these or allied systems is vital if the land in these areas is to be saved.

The last but by no means the least cause of our serious land position is the lack of expenditure of public funds in the past on agricultural research and investigational services. Without the necessary fundamental knowledge it is

impossible to plan a sound agricultural policy, especially in this Colony with its wide range of altitude, soil and climatic conditions. Whilst it is hoped that in the near future the Colony will be equipped with the necessary investigational stations and staff several years must elapse before results of practical and economic value can be expected.

Sufficient has been said to stress the vital importance of future planning on a long-range policy, a policy which only exceptional circumstances must be permitted to vary, if the future economy of this country is not to be jeopardized. It is therefore encouraging to be able to report excellent progress on these lines in some quarters in both European and African areas. Systematic intensive farming is becoming increasingly apparent on farms in the European areas and in the African land units there is an ever-increasing consciousness of the importance of the preservation of the soil. The introduction of permanent crops into the African lands is having a marked beneficial effect on the general agriculture in these areas.

DEPARTMENTAL

Another year has passed with little improvement in the general staff position and as a result certain departmental activities have had to be curtailed. Good progress has been made on many farms in the European areas by Agricultural and Soil Conservation Officers and sound farm planning is now becoming popular. The mechanical units of the Soil Conservation Service have been kept fully employed throughout the year and have been unable to cope with the many calls for assistance. In African areas good progress in terracing, manuring and generally better farming methods can be reported, but as yet only a beginning of the colossal task has been accomplished. Extension work is encouraging and there is growing co-operation amongst African farmers.

The research and investigational work of the department has again been seriously limited by the staff position. Individual technical and specialist officers with the co-operation of farmers have done valuable work, but not until additional staff and funds are made available will it be possible to co-ordinate satisfactorily the investigational work in order that the department can render the greatest benefit to the Colony.

EXPERIMENTAL WORK

Cereals

Wheat.—At the Plant Breeding Station, Njoro, three new hybrids and two importations from America have reached the bag stage. Five crosses are in F2 and seven in F4; selection of desirable segregates continued and cultures showing fixation were carried forward into the multiplication plot series. In a large proportion of the 21 new crosses which were made Regent was used for its good agronomic characteristics and baking quality. Forty-five new importations from Australia, America and India were under trial for the first time. At the breeding sub-station at the Scott Agricultural Laboratories, Nairobi, crossing and selection continued for the production of wheats suitable for short-season conditions, such as Northern Province, Tanganyika; two crosses remained free from stem rust and the more promising segregates will be carried on to multiplication plots in 1949. At the high-altitude sub-station at Molo work continues to produce wheats to replace Equator, which is not liked by mills on account of its poor baking quality. Pelschenke wholemeal fermentation tests are carried out as a matter of routine on all new hybrid material and samples of all advanced hybrids are sent to England for baking quality tests before release to farmers.

Ten new wheats and one purified and regenerated strain of an established wheat are under multiplication by farmers on a field scale. Four new wheats, 318.AJ.4.A.1, 261.R.7.C.1.B., 117.A.II and Rhodesian Sabanero were released to farmers from departmental control.

A survey of black stem rust forms in the Colony was carried out; physiologic forms K.1 and K.4 were found to occur most frequently. Rust found on a hitherto resistant wheat variety in Northern Province, Tanganyika, proved to be a new form K.8, which was subsequently multiplied at the Scott Agricultural Laboratories. K.8 differs from previously isolated forms in giving a susceptible reaction on Einkorn and varieties 112A and B.256.G.

Barley.—Twenty-eight importations from the United States and two from Bolivia were under test for the first time in Kenya, and Mariout, a six-rowed feeding barley from Canada, did well in yield trials. Two varieties, Research and Glacier, were released to farmers after being under test and multiplication since 1944.

Oats.—Twenty-two varieties of oats were under trial at Njoro and Molo, eight of them being importations from America, Australia and Southern Rhodesia under trial for the first time in Kenya. A Milling Oats Committee under the chairmanship of the Senior Plant Breeder was set up to ensure impartiality in the assessment of the quality and price of oats offered to mills.

Maize.—The eight hybrid corns received from Texas in 1947 were again tested together with a new importation from Southern Rhodesia. Only the last did at all well and will be tried again. Three South African hybrids were received during the year and will be tested in 1949.

All the foregoing work is described in greater detail in the reports of the Senior Plant Breeder and the Senior Plant Pathologist in Part III of this report.

Coffee

Further development of the new coffee research station at Ruiru was effected during the year. This station is the administration headquarters of the coffee services and much of the entomological and field work is carried on there. The chemical and plant pathological and physiological work, however, continued to be carried on at the Scott Agricultural Laboratories, but as the new laboratory and administrative block at Ruiru was started in December it is hoped that the whole of the staff will be working there by the end of 1949.

Field trials at Ruiru included two copper spray trials, a pruning and a crop reduction trial. Mulching, manurial, pruning and size of planting holes trials which have been conducted for several years at Kitale continued and are giving valuable results. Other field work of this nature continued at six sub-stations. Of these sub-stations, however, two were closed down; the remaining four are situated at Makuyu, Kiambu, Kitale and Mount Elgon.

Work on vegetative propagation of coffee has made such good progress that the experimental stage can now be considered to have been passed. Facilities for this work are being extended so that large numbers of rooted cuttings will soon be available for experimental planting and, later on, large quantities of first-generation seed will be available for sale to planters.

Little entomological investigational work has been possible as the only entomologist in the coffee services is in charge and is very much occupied with administration and advisory work, not to mention the development of the new coffee research station at Ruiru. The opportunity arose to carry out two experiments on *Antestia* control to compare the immediate and the residual effect of pyrethrum, D.D.T. and B.H.C. insecticides. The results of these experiments gave interesting indications of the possibilities of these insecticides; "Agrocide" wettable powder was perhaps the most promising under the conditions of the experiments. The addition of a synergist to pyrethrum was found to prolong its effectiveness.

The Agricultural Chemist's main lines of investigation have been on soil moisture and fertilizer factors in the nutrition of the coffee crop. Fertilizer trials at Ruiru continued and were extended to include very heavy soil applications and light foliage sprays of both sulphate and nitrate of ammonia. Counts were

made of dieback and yellowing on many hundreds of trees, foliage samples were tested for nutrients and herbage cuts analysed for phosphate uptake by weeds. Copper nutrition and leaf fall studies at the Scott Agricultural Laboratories were expanded as a joint experiment with the Plant Physiologist into a detailed study of 72 individual trees. Pore space and crumb structure studies were carried out on cultivation experiments and Napier grass plots at the Coffee Research Station.

The Plant Pathologist/Physiologist initiated experiments on the method of action of copper tonic sprays which have indicated that they act through their fungicidal nature and not because of their copper content. Flowering growth and soil moisture observations were continued throughout the year, but the Plant Pathologist was on overseas leave for the latter half of the year.

The work of the various sections of the coffee services is reported in detail in Part III of this report.

Fruit

With the return from overseas leave of the Agricultural Officer (Horticulture) in December, 1947, the development of the Fruit Research Station at Molo and of the fruit advisory services received his full-time attention and went ahead rapidly. In November another officer arrived on first appointment and was stationed at the coast where he will devote attention to coast horticulture in general and the citrus industry in particular.

Prolonged dormancy is an important limiting factor in the cultivation of deciduous fruits in the Kenya Highlands and at Molo encouraging results were obtained from oil-spraying of apple, pear, plum and apricot trees during the dormant period for the purpose of breaking this dormancy. Experiments on apple rootstocks, pear pruning, and nutrition of apples have been started together with trials of imported fruit trees and seeds.

A prototype fruit grader was shown at the Nakuru Show and is now in commercial production. New developments and experimental work are described in detail in the report of the Agricultural Officer (Horticulture) in Part III of this report.

Pasture

Work continued on the vegetation survey of the Colony, particular attention being devoted to the coastal areas. This survey is designed to provide information on the ecological regions demarcated by the major plant communities with the object of providing a basis for regional research. The problem of grass burning in the extensive *Acacia-Themeda* grassland of the Highlands is being studied. Near Thomson's Falls trials of various methods of management designed to suppress a useless coase-grass phase dominated by *Pennisetum schimperi* have shown that the correct use of fire as an instrument of management effects the desired change to the dominance of *Themeda triandra*. In experiments, which are in the early stages, on the management of deteriorated *Cynodon* (star grass) pastures in the Rift Valley there are already indications that rotational grazing treatments are effecting the suppression of useless *Aristida adscensionis* in favour of star grass.

The production of certain grass seeds used in the establishing of temporary leys continued to be stimulated; the demand for seed of molasses grass (*Melinis minutiflora*) and *Bromus marginatus* appeared to be satisfied, but supplies of seed of the Nzoia strain of Rhodes grass (*Chloris gayana*) continued to be short. Other indigenous grasses which are receiving attention in connexion with ley farming are *Pennisetum stramineum, Cenchrus ciliaris* (erect form), a species of *Setaria* from Nandi and an ecotype of *Melinis minutiflora*. Indigenous legumes are also being intensively studied. Details of this and other pasture research work are contained in the report of the Senior Agricultural Officer (Pasture Research) in Part III of this report.

Potatoes

Eight more varieties of blight immune potatoes were received from Great Britain and grown at the Scott Agricultural Laboratories for testing and multiplication. The most promising varieties tested during the year were 914a (12) and 1427a (8) and small nucleus stocks of these have been obtained for multiplication at a higher altitude where there is less likelihood of virus infection.

Pyrethrum

Field investigational work on pyrethrum continued to be centred at Ol'Joro Orok with sub-stations at Molo, Subukia and Kitale; the Kinangop sub-station was closed down. In various field trials it was found that mechanical cultivation was satisfactory provided it was carefully done, that wheat following pyrethrum yielded more than twice as much as wheat following *Bromus* and that the optimum spacing for pyrethrum was from 20,000 to 25,000 plants to the acre. A technique for propagating pyrethrum by means of cuttings is being developed. Three makes of mechanical transplanter were tried, but it was found that it was impossible to drive two of them slowly enough to enable slow-working African operators to carry out the work efficiently; the Robot transplanter, however, proved satisfactory but its high cost is a disadvantage.

There was some reduction in the number of field trials so that breeding work could receive more attention. Four hundred single plant selections remain at Ol'Joro Orok and Molo out of the original thousand selections. Of these nearly a third are over 2 per cent pyrethrins and 30 are over $2\frac{1}{2}$ per cent. Most promising lines have been sown in pairs for seed production and progeny trials will be carried out in 1949.

On the chemical side the main lines of work carried out during the year were on the depreciation of the pyrethrum content of baled flowers during storage and an investigation into the suitability, purity and general properties of petroleum solvents in relation to pyrethrum analysis. For further details of investigational work on pyrethrum reference may be made to the reports of the Agricultural Officer (Pyrethrum), the Senior Plant Breeder and the Senior Soil Chemist in Part III of this report.

Sisal

Investigational work on sisal is centred at the High-level Sisal Research Station, Thika, but there has been a new development this year in the establishment, in co-operation with planters, of external trials, designed to cover the four factors of spacing, plant density, age at first cut and interval between cuts. Four such trials have been laid down, two in Central Province, one in Nakuru and one in Trans Nzoia.

At the station itself, although neither the cutting nor the spacing trial has reached its final stage, there are certain trends which can be indicated now without prejudice to the final results. Heavy cuts and short intervals between cuts have been found to retard plant growth and to shorten the subsequent leaves. An early light cut appears to be beneficial to the plants. Light cuts with intervals of not less than a year do not seem to have a depressing effect on the plants or to retard poling. With regard to spacing, high populations are essential if high yields are to be secured. As the planting distance between plants in the rows should not be less than 30 in., and the distance between rows depends on the mechanical means for cultivation, double-row planting seems to be unavoidable if the number of plants to the acre is to be increased.

Further details of this experimental work and an account of the development of the station will be found in the report of the Agricultural Officer (Sisal) in Part III of this report.

Scott Agricultural Laboratories

Although with the continued fall in the exports of baled pyrethrum and the completion of laboratory work on the kiln preparation of sodaphosphate there were marked decreases in the numbers of samples of pyrethrum and fertilizers analysed, the number of all classes of samples dealt with in the chemical laboratories increased by 148 to a total of 1,349. The greatest increase was in soil samples which form more than half this total; nearly a quarter of these samples were received in connexion with the examination of potential tea soils.

The main item of investigational work was the continuance of pot culture work on the relative availability of different classes of phosphatic fertilizers when added in different ways to different soil types. Trials in 1948 confirmed that the root solubility or early availability of sodaphosphate was about proportional to the contained citric-soluble phosphate and that high grade sodaphosphate was about equally early available as superphosphate. The intake from sodaphosphate was found to be greater with placement in the soil than when it was dressed on to the seed whereas with triplesupers the reverse is the case. Triple superphosphate was found to reduce germination when dressed on the seed, but this effect could be avoided by previously neutralizing this fertilizer with lime; on the other hand the reduced solubility of this material resulted in the phosphate intake being about halved. While these pot culture trials have shown that the intake of phosphates by seedlings is about as good for sodaphosphate as for triplesupers, statistical field experiments with cereals have shown a greater response to the latter class of fertilizer, and there is not sufficient evidence at present to warrant the use of Uganda rock phosphate by itself for annual crops.

A great mass of soil data dealing mainly with the morphology of natural soil profiles has been gradually sorted out and a first attempt has now been made to classify local soils, the basis of classification having to be varied according to the different generic factors involved. About 100 different conditions of natural soil conditions which had previously been recorded have been classified and described giving 70 named soil series and 30 named soil fascs. An account of a suggested system of classifying tropical and sub-tropical soils was presented at conferences in the United Kingdom and the Belgian Congo.

Some initial work on the development of crumb structure under different grass covers has shown that there are marked local variations in soil aggregation and that caution is necessary in drawing conclusions based on laboratory work. Different soils have different types of distribution curves for aggregates and it has been found more correct to use calculated single values based on the proportion of several fractions present and not on a single arbitrary fraction for all soils.

Further trials with selective weed-killers have shown that under local conditions dusts are less effective than sprays with a large number of weeds. While it was necessary to apply 3–4 lb. of active agent per acre as dusts to destroy most weeds, about 2 lb. applied as a spray were effective. Future field trials are to be confined to sprays. There is some evidence that the 2-4-D type of weed-killer is more effective than the M.C.P.A. type for local weeds.

The Senior Entomologist controls the operation of the Plant Protection Ordinance, 1937, and rules made thereunder; the work involved remained at a considerable volume, nearly 700 plant importation permits being issued during the year. The bulk of the plant material imported was inspected at Mombasa by the Chief Grader and Inspector and most of the remainder, including air freight, at Nairobi by the entomological staff. Ninety-three plant export certificates were issued.

Investigational work carried out by the entomological division included investigations of various aspects of the maize stalk-borer problem and of the control and bionomics of the chafer grub. Further trials of spraying prickly pear

with D.N.O.C. in diesel oil showed this to be ineffective in eradicating the plant, even with several successive sprayings. Further experiments on this subject are planned. A survey of the stored products insects in foodstuffs was begun and large numbers of such insects were obtained and have been identified by the Commonwealth Bureau of Entomology. Experiments on the protection of stored maize with insecticides were begun. Further details of this work and a record of certain pests occurring during the year are contained in the report of the Senior Entomologist in Part III of this report.

Reference has been made above to the Senior Plant Pathologist's work in connexion with wheat and potatoes. Take-all of wheat, *Ophiobolus graminis*, was of occasional occurrence on the Plateau and advice on the preparation of inoculum and the treatment of soil was given in an experiment to test the carry-over potentialities of *Bromus marginatus* in the rotation; this grass has not, so far, been proved to be susceptible to Take-all and trials to ascertain this are being carried out. A disease of maize in various localities west of the Rift Valley, which causes rot of the nodes and the base of cobs, was investigated; it appears that the disease starts as a bacterial infection, but although cultures were made of the organisms it was not found possible to carry out inoculations.

Considerable demands have been made on the time of the Senior Plant Pathologist in connexion with work on forest pathology. *Monochætia unicornis*, canker of *Cupressus*, continues to cause much concern and threatens the establishment of *C. macrocarpa* stands in the Mount Kenya district, and during the year the disease was confirmed on the Aberdares and west of the Rift Valley. Further study has revealed the existence of strains of varying virulence which differ markedly in cultural characters and particularly in the capacity to sporulate on artificial media. Studies in susceptibility of species of *Cupressus* and other conifers are being pursued, and experiments on the mode of entry of the fungus are in progress.

Much of the time of the pathological section is occupied in dealing with specimens of diseased plant material which arrive at the laboratories at the average rate of one a day The identification of these specimens and the giving of advice, where possible, on the control of the diseases calls for much *ad hoc* investigation and until the section is strengthened by the filling of the existing vacancy for a Plant Pathologist, there will continue to be little opportunity for major research. Details of the large number of diseases on a wide range of hosts which have received attention during the year are given in the report of the Senior Plant Pathologist in Part III of this report.

Seasonal conditions at the Scott Agricultural Laboratories were not abnormal: both the long and the short rains were good, although the latter were rather delayed. The field work at the laboratories consisted of a large number of trials of miscellaneous vegetables, herbs, cereals and other food crops, fibres and tobacco, together with the planting or maintenance of certain crops, as pyrethrum, coffee and passion fruit, for use in the investigational work of specialist officers. Amongst the fibres, sunn hemp from Southern Rhodesia grew well and stood up to dry conditions but *Urena lobata* did not do well although it produced plenty of seed. Details of this field work are to be found in the report of the Senior Soil Chemist in Part III of this report.

The Plant Breeding Station, Njoro

The work of the Senior Plant Breeder in connexion with cereals and pyrethrum has already been referred to. At the Plant Breeding Station, Njoro, in the course of trials of other crops semi-dwarf sunflowers did not yield so heavily as the standard variety giant black. Twenty-six varieties of soya beans from America, South Africa and Southern Rhodesia were tried at Njoro and other stations, but few of them showed much promise.

Other Experimental Stations

In the European areas investigations into various aspects of good farming practice are concentrated at the experimental farms at Kitale and Ol'Joro Orok. The department is still unprovided with satisfactory investigational stations in the great African areas, and such work which it is possible to carry out is limited in scope and confined to the land at the department's agricultural training schools and farms financed mainly for seed bulking purposes by local native councils. It has been agreed, however, to establish a coast investigational station at Matuga, some 15 miles south of Mombasa, which will include crop and animal husbandry and horticulture; development of this station has already begun.

EXTENSION WORK

The organization of the department's extension services has developed to a further stage by the posting of a Senior Agricultural Officer to Nakuru to be in charge of all the field services in the Rift Valley Province, thereby bringing this province into line with Nyanza, Central and Coast. This officer now directly supervises both the field advisory services in the main European farming area stretching from Kitale to Naivasha and from Molo to Naro Moru and the extension work in the native districts of West Suk, Elgeyo-Marakwet, Nandi, Kamasia and Samburu.

Agricultural officers in European areas have continued to devote much of their time to the operation of the Increased Production of Crops Ordinance, but the pressure of this work is lighter than in recent years. This has enabled more time to be given to general advisory work for which there is an ever-increasing demand, particularly from new settlers and from old-established farmers who wish to turn from cereal monoculture to mixed and ley farming. Several hundreds of visits were made by officers to farms in addition to attendance at meetings of farmers' associations. Farmers' days were organized and educational exhibits were staged at the Country Comes to Town Exhibition in Nairobi in January and the Royal Agricultural Society of Kenya's Show at Nakuru in October.

Further increases in subordinate European agricultural staff have been possible in many districts. On the one hand, this has enabled the officer in charge of a district to concentrate more on the general development policy of his district, while on the other it is now possible to devote closer and more detailed attention to various parts of the district and in many cases to individual progressive farmers themselves. Although district officers have been relieved of much marketing work by the appointment, under Maize Control, of marketing officers, the wider aspects of marketing and produce inspection continue to demand much of their attention. Apart from marketing the more important lines in extension work in native areas are the insuring so far as possible of basic food supplies, the stimulation of the production of exportable surpluses of basic foodstuffs for East African use and of revenue-producing crops, some of which have received little attention of recent years owing to the over-riding demand for food production, and above all the conservation of the soil and the development of a farming economy on a sound basis. For this last, emphasis is laid on the interrelationship of crop and stock husbandry, the use of manure, the improvement of natural pastures and the use of temporary leys. Thus it is only in matters of degree and detail that extension work differs between non-native and native areas.

One development in "better farming", which has received much attention in Nyanza Province during the year, has aroused great interest and shows promise of going ahead strongly, is the establishment of a group farming system. This system aims at the adaptation of indigenous control of land usage to meet the full and intensive production demanded by a growing and advancing African society while maintaining a high standard of soil fertility. It is described in detail in the report of the Senior Agricultural Officer, Nyanza Province, in Part III of this report and the rapidity of its spread is shown by the increase during

the year from one group of 14 members to 27 groups with a membership of over 400 and control of nearly 9,000 acres. In addition to this development there is increasing acceptance of the necessity of applying manure to the land, but even so dung and trash burning remains far too prevalent, while tree planting to provide an alternative source of fuel proceeds far too slowly.

While the group farming conception is acceptable to a large degree in Nyanza Province, the inhabitants of Central Province, particularly the Kikuyu districts, are much more individualistic in outlook and here the emphasis must be more on the individual good farmer. There are a number of these good farmers and the future of the African lands of this province depends largely on either the conversion of lazy and the education of backward farmers or their replacement by good farmers. There is a tendency for the growing farmer class to purchase land and these keen progressive men are increasingly ready to seek and act on advice from this department. The use of manure is one direction in which real progress can be seen. It is reported from Fort Hall:—

> "In the higher areas paddocking is proceeding apace and the number of cattle sheds which have been built and are being used is legion. There is an ever-growing intelligentsia who appreciate the value of manure and demands for manure exceed the available supply manyfold".

Against this picture must be placed the attempted boycott of imported manure in part of Nyeri district, the absentee landlord who plants up his land to wattle and goes away to live as a squatter and the embryo trader who supports uneconomic business by mining the land. Progress there is in all areas, but it is a matter of grave concern to the country as a whole that at present the rate of this progress is not great enough to enable the African lands even so much as to hold their own with deterioration of fertility in the face of a rapidly increasing population, let alone overtake and recover from the deterioration and loss of many years. The answer to the problem of the African lands is not necessarily the breaking up of hitherto unoccupied areas, but the intensive care and treatment of the congested lands to a standard approximating to European market gardening.

SOIL CONSERVATION

The year saw a further increase in the amount of terracing carried out in European farming areas, the department's Soil Conservation Service operating on a total of 123 farms. The amount achieved is however all too small compared with the magnitude of the needs, and at the present rate of progress some 50 years would probably be needed to cover all the ground which should be dealt with. Even this is on the assumption that all terracing once done is kept in good order, whereas it is known that much work is lost particularly where continued cultivation has reduced the structure of the soil to a powder which readily sheet erodes and fills up the channels of terraces.

The slowness of progress is due partly to shortage of trained staff, particularly of officers experienced enough to plan large-scale conservation schemes covering whole farms or larger areas. The more immediate cause is, however, the continued lack of tractors. The accessions during the year comprised only two T.D.18 tractors on loan from the African Land Utilization and Settlement Board which are really too heavy to operate terracers and one D.4 Caterpillar tractor for use on the light soils of Nakuru district. Not one of the balance of several D.6 tractors which have been on order for years and which are the most useful type was received during the year.

On the staff side, five new appointments of Assistant Soil Conservation Officers were made, but three appointments were terminated for various reasons. Difficulty continues to be met in securing the required number of Africans sufficiently educated to undertake the duties of levellers; for this work education to at least junior secondary school standard is required and as with the general field staff progress will only begin to reach the requirements of the Colony when

the general intake of trained African staff can be at at least this level of education, with an increasing number educated to the School Certificate standard.

The soil conservation inspection services, which operate under the provisions of the Land and Water Preservation Ordinance, are under the control of Senior Agricultural Officers in charge of provinces. There are now five inspectors stationed at Kitale, Eldoret, Lumbwa, Nakuru and Thomson's Falls and they are very fully occupied in checking the maintenance of terracing work already done, in advising farmers on soil conservation practice and needs and in operating land preservation legislation in some cases to the extent of prosecution in the courts.

The future of the general headquarters and the Nakuru district headquarters was decided during the year and to this end a piece of land was purchased on the outskirts of Nakuru. Development of this area will begin in 1949, and when buildings are available the district headquarters will be transferred from its temporary accommodation at Njoro and the general headquarters will move from Kitale. In the meantime it has been necessary to erect further temporary accommodation at Kitale. Permanent European and African quarters, together with an office and store, were built at the Elodert headquarters and further development took place at Lumbwa and Thomson's Falls.

It has been decided to site the Nairobi district headquarters on part of the Rukera Estate, Ruiru, which was bought primarily to increase the facilities for coffee research.

Little real progress proportional to the need can unfortunately be recorded in Nyanza Province where the achievements in narrow-base terracing, although considerable in actual yardage, were very little per head of the population concerned. Terracing is an extremely unpopular operation and very arduous, and the easier methods of trash lines, contour grass strips and contour ploughing were adopted more readily in some areas. The picture in Central Province is a little more encouraging, but although progress has been made and political activity has been less than in 1947 the repercussions of the trouble in Fort Hall in that year were still felt. Marked progress, however, took place in Embu and even more so in Nyeri district, where over 7,000 acres were terraced and much of the district is quite changed in appearance. Nevertheless, the figure of 50,000 acres terraced during the year in the whole of Central Province is all too small compared with the country's urgent needs.

Some progress is recorded in Coast Province, mainly in the direction of trash lining and the closure to cultivation of very steeply sloping land in the Teita Hills and the southern Kilifi Highlands. Narrow-base terracing is becoming more widely adopted in the native areas of Rift Valley Province.

The Dam Construction Unit (now known as No. 1 Unit as a second is being formed) operated by the Soil Conservation Service was working in the Thomson's Falls area until September, when it was transferred to undertake a big programme in Machakos. Fifteen dams were constructed before the move, the biggest being one near Rumuruti with a capacity of 320.5 acre/feet. Work was slow in Machakos after the move owing to much more difficult conditions accentuated by heavy rain, silting and inferior cement. The finances of dam construction have now been separated from those of the Soil Conservation Service, and No. 1 Unit is now operating on a self-supporting basis. The second unit is being formed with a similar establishment but with Allis-Chalmers tractors (HD.10) instead of Caterpillar tractors (D.7).

AGRICULTURAL EDUCATION

At the Egerton School of Agriculture, Njoro, the third one-year Certificate course was held and completed. Eighty-six men were in training and 44 wives and some two dozen families were also in residence in the early part of the year. An average of 45 students attended two popular one-month refresher courses for established farmers, experienced Settlement Scheme candidates and depart-

mental officers. Several additions and improvements were made to European accommodation and further African housing was erected. The health of students and staff was very good and students' welfare was well catered for through their representative committees.

The school farm embraces many activities essential to proper tuition in practical farming, and a proper balance between plough- and grassland is being achieved. In spite of erratic rainfall the year was as a whole satisfactory and a gross return of £4,341 was obtained from sales of crops, dairy and pig produce.

An average of 50 African students were in residence at the Agricultural Training School at Bukura in North Nyanza, together with five pupil teachers. These students take a two-year course designed to give a general grounding in the theory and practice of agriculture to fit them for employment as Agricultural Instructors in the department's field services. Part of the farm land was relaid out as a demonstration group farm in connexion with the development already described above in the section on Extension Work. The combined training centre at Maseno is expected to be ready in 1949.

The Agricultural School, Embu, continued to be run on the seed farm. Owing to limited accommodation until the new school is built at Kangaro only 22 students were in residence. Some progress was made with the farm at the new school site; the farm buildings are ready, paddocks have been fenced and part of the experimental block has been cleared. The school buildings are being erected and arrangements are being made to open with an increased number of students in 1949 for their normal two-year agricultural course.

At the coast it was found possible to reopen the agricultural training school at the Kibarani Station, Kilifi, and ten pupils completed the first year of a similar two-year course. A new school is planned as part of the activities of the Investigation Station now being developed at Matuga in Digo district.

PRODUCE MARKETING AND INSPECTION

The staff of marketing officers in Nyanza Province became stabilized during the year and as the officers became more experienced so they were able to take over duties previously carried out by the staff of this department. The food shortages which have already been referred to, however, diverted large quantities of foodstuffs from organized markets to internal consumption and marketing was virtually at a standstill from April to August. In Central Province additional appointments of marketing officers were made; in contrast with Nyanza Province marketing operations were brisk and the quantities handled were much greater than in recent years.

Produce inspection in Central Province continued to be concerned largely with wattle bark; a general improvement in the quality sold took place but only by virtue of the continued efforts of the inspection services. The standard of inspection of general produce in Nyanza Province remained high, particularly in North Nyanza and Kericho districts; it is worthy of note that because of its high quality supplies of maize from Bugoma Station were sent to Uganda for seed purposes.

Two perennial difficulties regarding transport arose again in 1948. There was the usual congestion in the gulf ports of South Nyanza District owing to inadequate lighterage facilities between them and Kisumu. In Central Province the Railway Administration's shortage of trucks prevented wattle bark being railed to factories as quickly as it was brought in and the usual congestion occurred; accommodation for bark storage at railhead is now a most urgent need.

Increasing interest in co-operative marketing is evident in both Nyanza and Central Province. In the former eggs and poultry are the most important products being handled in this way. In Central Province, however, co-operative societies are being registered for a greater variety of commodities including pigs, plums, vegetables and pineapples.

GRADING, INSPECTION AND COOL STORES SERVICES

During the year only 76,803 bags of maize were received for grading. Of these only 1,330 bags were received direct, the great bulk of the maize being conditioned prior to grading either at Kilindini or at Nairobi. Of this, 58,539 bags were graded as Undergrade, Conditioned (K8C), but 15,773 bags of maize conditioned at Nairobi had to be rejected owing to reinfestation after treatment which brought the amount of defectiveness too high even for Undergrade. This maize was permitted to be exported under an inspection certificate (Rule 12).

Most of the 72,250 bags of wheat submitted for inspection was graded as First Grade (K1), 37,483 bags direct and 20,576 bags after heat treatment at Kilindini. Other grading included 20,361 cwt. of potatoes and 17,096 bags of beans.

The Kilindini Conditioning Plant treated 93,628 bags of maize, beans, wheat, pulses, rice and millet in 1,755 hours and the Nairobi plant 363,370 bags of maize, wheat and pulses in 5,826 hours. The fumigation chamber at Kilindini treated 22,212 bags of produce, mostly beans.

The total weight of produce stored in the Cool Stores, Kilindini, was 1,600 tons, a drop of 5.7 per cent compared with 1947. This drop was due entirely to a 25 per cent reduction in butter for export, practically all other commodities showing increases. All the plant under the control of these services continued to operate very satisfactorily.

LIBRARY

Some 275 new books were purchased during the year and the following periodicals were added to those already taken by the department: *Journal of the Soil Conservation Service of New South Wales, Journal of Genetics, Plant and Soil, Curtis's Botanical Magazine* and *African Affairs*. Some 2,100 publications were circulated during the year, of which about 1,600 went to members of the department and 550 to members of the public. This excludes books and periodicals sent to out-stations for retention. There was a marked demand among members of the public for literature on local conditions; in general fruit and vegetables headed the list of subjects most in demand, followed by dairying and poultry. The cereal crops would also have been high on the list had more literature on local conditions been available. Forty-eight new depositors joined the library. A start was made with building up the provincial libraries; it is hoped to extend these during 1949. In order that officers might be aware of new purchases, the practice of circulating accession lists was revived.

PUBLICATIONS

The following is a list of articles contributed by departmental officers to local journals:—

East African Agricultural Journal

VOL. 13—JANUARY–APRIL.

"A Method for the Preparation of Silicophosphate on Farms"—G. H. Gethin Jones, Soil Chemist.

"Weed Killers"—V. A. Beckley, Senior Agricultural Chemist.

"Essential Oils"—V. A. Beckley, Senior Agricultural Chemist.

"Kavirondo Perennial Sorghum: An Improved Type"—D. C. Edwards, Senior Agricultural Officer (Pasture Research).

"Temporary Ley Grass Trials on the Uasin Gishu Plateau"—W. A. C. Bouwer and L. R. Strange, Assistant Agricultural Officer.

"Some Notes on the Food of Goats in a Semi-arid Area"—L. C. Edwards, Assistant Agricultural Officer.

Vol. 14—July–October.

"A Note on the Deterioration of the Toxic Content of Separated Pyrethrum Achenes compared with that of Whole Flowers"—J. Hopkins, Agricultural Chemist (Pyrethrum).

"Note on a Method of Preserving Separated Milk as Cheese"—M. A. Barrett, Agricultural Officer.

"A System of Composting Farm and Village Waste"—F. B. Wilson, Agricultural Officer.

Coffee Board Bulletin

Articles appearing in the monthly bulletin of the Coffee Board of Kenya are listed in the report of the Officer in Charge (Coffee Services).

The Kenya Pyrethrum News

"Pyrethrum as a Rotation Crop"—U. Kroll, Pyrethrum Assistant.

"Ramularia Bud Disease"—E. W. Gaddum, Agricultural Officer (Pyrethrum).

"The Rotation of Pyrethrum"—E. W. Gaddum, Agricultural Officer (Pyrethrum).

"The Germination of Pyrethrum Seed"—U. Kroll, Pyrethrum Assistant.

The Settler

"The Spacing of Pyrethrum"—E. W. Gaddum, Agricultural Officer (Pyrethrum).

"Imported Strains of Pyrethrum for the Low Altitudes"—E. W. Gaddum, Agricultural Officer (Pyrethrum).

"The Seed Maize Competition"—H. C. Thorpe, Senior Plant Breeder.

"Bud Disease: A Short History"—E. W. Gaddum, Agricultural Officer (Pyrethrum).

"Bulking of Improved Strains of Pyrethrum for Issue"—E. W. Gaddum, Agricultural Officer (Pyrethrum).

"Maize Seed Selection"—H. C. Thorpe, Senior Plant Breeder.

"Use of Mechanical Transplanters in Planting Pyrethrum"—E. W. Gaddum, Agricultural Officer (Pyrethrum).

Other publications by members of the department which appeared during the year were:—

"Africans and their Land", Books 1–3 ("The Land and its Problems", "Crops and Soil Fertility", "Animals and Soil Fertility"), by Norman Humphrey, Senior Agricultural Officer.

"Peasantry or Prosperity?" by Colin Maher, Senior Soil Conservation Officer.

"Latent Infection in *Coffea Arabica* L."—R. W. Rayner, Pathologist and Physiologist (Coffee Services) in *Nature*, Vol. 161, No. 4085, pp. 245–6, February, 1948.

"Breeding Better Pyrethrum"—H. C. Thorpe, Senior Plant Breeder, *Pyrethrum Post*, Vol. 1, No. 2, October, 1948. (This article also appeared in *The Settler*.)

"Pyrethrum and Good Farming"—U. Kroll, Pyrethrum Assistant, *Pyrethrum Post*, Vol. 1, No. 2, October, 1948. (This article also appeared in *The Settler*.)

Papers were submitted by G. H. Gethin Jones, Senior Soil Chemist, and C. A. Maher, Senior Soil Conservation Officer, to the International Soil Conference held at Goma in the Belgian Congo in November and to the Conference on Tropical and Sub-tropical Soils held in the United Kingdom earlier in the year.

AGRICULTURAL LEGISLATION

The following comprise the more important legislative changes affecting agriculture during 1948:—

European Agricultural Settlement Ordinance, 1948.—Prescribes the appointment and duties of the European Agricultural Settlement Board; the establishment of the European Agricultural Settlement Fund and the purposes for which it may be used, including advances to assisted owners and the conditions of such advances; regulations under the Ordinance.

Hide and Skin Trade Ordinance, 1948.—Restricts the purchase of hides and skins except under licence; prescribes conditions, etc., of licence; restricts export except under licence; prescribes the registration of premises, appeal procedure, inspections, offences, etc., and the power to make rules.

Seeds Ordinance, 1948.—Prescribes the establishment of seed-testing stations, control of the import, export and sale of seeds; conditions for certificates; registration of seed-growers; general powers of inspectors; miscellaneous provisions; powers to make rules; offences and penalties. This Ordinance has not yet come into operation.

Tea Ordinance, 1948.—Proscribes planting except under licence; lays down conditions for replanting; restricts the export and import of tea seed; the form and conditions of licences and permits; inspectors' powers; returns; penalties for offences.

Grading of Chillies Rules, 1948.—Lays down conditions for the export of chillies on the same lines as those for the grading of other produce under the Agricultural Produce Export Ordinance.

Other legislation enacted during the year was as follows:—

Ordinances

An Ordinance to amend the Coffee (Marketing) Ordinance, 1946.

An Ordinance to amend the Flax Ordinance, 1939.

An Ordinance to amend the Land Control Ordinance, 1944.

An Ordinance to amend the Sisal Industry Ordinance, 1945 (two).

An Ordinance to amend the Sugar Ordinance.

Rules and Regulations

Crop Production and Livestock Ordinance: Wattle Bark (Improvement and Inspection) (Amendment) Rules and (Amendment No. 2) Rules. Emergency Laws, etc.: Control of Hides, Skins and Leather Regulations, 1945: price of hides. Control of Maize Regulations, 1944: amendments to; revocation of orders *re* containers; movement of; prices for native producers. Controlled Produce Regulations, 1943: amendments to schedule; movement of. Hide and Skin Trade Ordinance, 1948: Imposition of Cess Rules, 1948; section 21, date of operation. Increased Production of Crops Ordinance, 1942: book value, crops retained on farms, 1947; continuation in force of; guaranteed f.o.r. prices, maize and linseed; Guaranteed Minimum Return Rules, 1948; harvesting returns, 1947 crop; prices of wheat, oats and barley; planting programme, 1948. Land and Water Preservation Ordinance, 1943: General (Amendment) Rules, 1948. Native Lands Trust Ordinance, 1938: Reconditioning of Makueni Area Rules, 1947; Removal of Common Minerals (Amendment) Rules, 1948. Plant Protection Ordinance, 1937: Fines Rules, 1948; planting dates of maize and sorghum. Pyrethrum Ordinance, 1938: Planting of Trees Rules, 1948.

STAFF

Mr. D. L. Blunt, C.M.G., relinquished his duties as Director on retirement on 30th April. First appointed to Kenya in 1926 as Senior Agricultural Officer he was promoted to Director of Agriculture, Cyprus, in 1933 and to Nyasaland in 1937. He returned to Kenya as Director in 1939. I wish to express again the department's deep appreciation of Mr. Blunt's leadership during the difficult years of the war and since the cessation of hostilities.

Mr. S. Gillett, Senior Coffee Officer since 1st January, 1946, continued to be seconded to the European Settlement Board as Commissioner until 1st April when he assumed the duties of Director of Agriculture on Mr. Blunt's departure. He was substantively promoted to the post of Director on 1st October, but had proceeded on overseas leave on 7th July, returning on 29th December.

Mr. G. M. Roddan was appointed Deputy Director on 29th May, 1948. Mr. Roddan was first appointed as Agricultural Officer, Sierra Leone, in 1930 and served for some years in the Colonial Office prior to coming to Kenya. He acted as Director from 7th July to 29th December.

Mr. W. O. Sunman, Assistant to the Director, was promoted to the new post of Assistant Director on 1st January, 1948. He continued to act as Deputy Director until 29th May, and acted for a further period from 7th July to 29th December.

The staff of the department continued to be considerably below the established strength during 1948, particularly in respect of the Colonial Agricultural Service. Mr. G. W. Anderson, Agricultural Officer, transferred to Zanzibar and Mr. F. B. Wilson, M.B.E., arrived on transfer from that territory. New appointments included Mr. G. R. Henderson and Mr. E. S. Porter, Agricultural Officers, Mr. A. Bolton, Plant Breeder, and Mr. J. F. Graham, Entomologist, transferred from the E.A. Anti-Locust Directorate. With the abolition of the post of Senior Coffee Officer on Mr. Gillett's promotion, Mr. A. R. Melville, who had been promoted Senior Entomologist (Coffee) (Supernumerary) in 1947, became substantively in charge of the Coffee Services on 1st October, 1948.

In concluding this report I wish to record my grateful appreciation of the zeal put into all work by the whole departmental staff. My thanks are also due to the wholehearted co-operation and support of the Administration and other departments without which much of the progress reported could not have been made.

STUART GILLETT,
Director of Agriculture.

PART III—SECTIONAL REPORTS

ANNUAL REPORT OF THE SENIOR AGRICULTURAL OFFICER. NYANZA PROVINCE, 1948

Staff

European

Kisumu—

Mr. P. C. Chambers, S.A.O.: 1st Jan. to 31st Dec.
Mr. A. W. Allen, Clerk I: 1st Jan. to 31st Dec

Kakamega—

Mr. G. W. Anderson, A.O.: 1st Jan. to 1st March.
Mr. F. B. Wilson, A.O.: 11th Feb. to 31st Dec.
Mr. G. D. Bailey, A.A.O: 1st Jan. to 31st Dec.
Mr. J. C. Todd, A.A.O.: 1st Jan. to 17th Dec.
Mr. E. J. Paulson, A.A.O., 1st March to 31st Dec.
Mr. B. R. Dudin, Marketing Officer: 1st Jan. to 31st Dec.

Kimilili—

Mr. P. Thoms, A.A.O.: 1st Jan. to 31st Dec.

Maseno—

Mr. A. E. Pound, A.O.: 1st Jan. to 31st Dec.
Mr. N. K. Whitton, A.A.O.: 1st Jan. to 9th March.
Mr. J. W. Duthoit, A.A.O.: 1st Jan. to 31st Dec.
Mr. H. M. Morgan, A.A.O.: 10th Feb. to 30th May.
Mr. G. D. S. Howes, A.A.O.: 3rd Jun. to 31st Dec.
Mr. G. M. Lavers, S.A.A.O.: 15th Oct. to 31st Dec.
Mr. J. W. Moore, A.A.O.: 8th Nov. to 31st Dec.
Mr. H. C. L. Farrar, A.A.O.: 20th Nov. to 31st Dec.
Mr. A. H. F. Scott, Marketing Officer: 1st Jan. to 25th Oct.
Mr. P. D. H. Megson, Marketing Officer: 14th Oct. to 31st Dec.

Kisii—

Mr. A. W. Thompson, A.O.: 1st Jan. to 9th May.
Mr. E. C. M. Green, A.O.: 28th April to 31st Dec.
Mr. J. R. Clerke, A.A.O.: 1st Jan. to 31st Dec.
Mr. G. M. Hart, A.A.O.: 20th Feb. to 31st Dec.
Mr. J. M. K. Slater, Marketing Officer: 1st Jan. to 31st Dec.
Mr. W. Haugh, Marketing Officer: 6th Sept. to 31st Dec.

Kericho—

Mr. G. Gamble, A.O.: 1st Jan. to 31st Dec.
Mr. J. P. Dallas, A.A.O.: 1st Jan. to 31st Dec.
Mr. H. S. Scott, A.S.C.O. (Inspector): 20th Nov. to 31st Dec.
Mr. W. M. Blow, Marketing Officer: 1st Jan. to 10th May.
Mr. K. J. E. Howe, Marketing Officer: 6th Sept. to 31st Dec.
Mr. P. D. H. Megson, Marketing Officer: 1st May to 14th Oct.

Bukura—

Mr. G. M. Lavers, S.A.A.O.: 1st Jan. to 9th March.
Mr. N. K. Whitton, A.A.O.: 9th March to 31st Dec.
Mr. H. M. Morgan, A.A.O.: 30th May to 31st Dec.
Mr. J. C. Todd, A.A.O.: 17th Dec. to 31st Dec.

Lumbwa—

Mr. G. H. Dukes, A.S.C.O.: 1st Jan. to 31st Dec.

Asian

Mr. Sampuran Singh Gill: 28th July to 31st Dec.

African

The strength on 31st December, 1948, was:—

	Agricultural Department	*Local Native Councils*	*Total*
Agricultural Assistants	3	—	3
Clerks	7	1	8
Instructors	245	—	245
Teachers	1	—	1
Pupils	48	—	48
Assistant Instructors	—	333	333
Levellers	—	4	4
River Scouts	36	—	36
Produce Inspection and Market Staff	2	208	210
Artisans and Labour	113	139	252
Tree Nursery Staff	—	135	135

Some clerks and other staff paid by Maize Control and labour engaged on dam construction, improvement and cleaning paid from district Agricultural Betterment Funds also came under departmental supervision. During the year one Agricultural Assistant and two Instructors were seconded to the East African Highlands Fertilizer Scheme.

Seasonal Conditions

The long rains were late but, once broken they were generally very satisfactory. The short rains started early and were at first promising, but petered out quickly—and were of little value. Dry weather prevailed both at the beginning and the end of the year. Conditions were generally less satisfactory in the north and the east of the province than in the south and south-east. Hail was less severe than normal.

Rainfall

	1948	Average
	Inches	*Inches*
North Nyanza:—		
Kakamega D.C. ..	60·28	75·29 (27)
Bukura (Agric. Dept.) ..	62·43	67·75 (24)
Central Nyanza:—		
Maseno (Agric. Dept.) ..	56·78	64·73 (7)
Kisumu-Londiani:—		
Kisumu (Met. Station) ..	40·23	48·94 (9)
Muhoroni (Station) ..	45·10	61·96 (43)
Miwani (Station) ..	35·05	49·46 (18)
Fort Ternan (Kipteris) ..	38·71	49·50 (29)
Lumbwa (Station) ..	37·61	45·39 (43)
Kericho:—		
Kericho (D.C.)	75·36	71·27 (43)
Sotik (Kivoga Estate) ..	47·26	53·20 (11)
Sotik (Tenwick Mission)	45·33	52·44 (8)
South Nyanza:—		
Kisii (D.C.)	62·60	66·80 (37)
Murumba	75·86	96·96 (6)
Rapogi (Catholic Mission)	49·01	50·70 (4)

(The number of years that records have been kept is shown in brackets in each case.)

European Agriculture

Despite the low total rainfall in Kisumu-Londiani District, seasonal conditions in the European areas were favourable, particularly for maize, good crops of which were harvested.

Coffee and tea felt the dry weather early in the year but recovered well thereafter; some tea plantations at Kericho were, however, badly hit by hail. Tea expansion continues rapidly both at Kericho and at Sotik, new nurseries being established and new plantings generally taking very satisfactorily.

The small areas of pyrethrum and passion fruit were maintained. The pyrethrum did well where satisfactory weed control was possible, while passion fruit paid growers handsomely, its extended production being limited only by an unwarranted fear of woodiness disease. Some beans were interplanted in passion fruit and young tea.

The demand for soil conservation work both on mixed farms (where some 510 acres were protected) and on tea plantations (where some 470 acres were protected) was heavy, progress being limited only by shortage of staff and equipment. It is now possible that all new tea plantings in Kericho will be contoured. In Sotik, a considerable number of squatter holdings were narrow-base terraced but the position generally—and especially in North Lumbwa—remains unsatisfactory. Proceedings are pending against one European farmer for persistent refusal to maintain adequate soil conservation measures.

The number of cattle kept in the mixed farming areas continue to increase, though outbreaks of foot-and-mouth disease and bovine pleuro-pneumonia caused much concern. One farmer suffered losses (of sixty head of grade cattle) through the breakdown of rinderpest vaccine. Some stock were lost in the dry weather at the end of the year. Removal of surplus African stock, which are increasing rapidly, was held up by the quarantine restrictions enforced as a result of the disease outbreaks.

Indian Agriculture

With the posting of Mr. S. S. Gill, Asian Agricultural Assistant to help, extension of advisory services and initiation of investigational work into sugar varieties and cultivation methods became possible and were started. The Eldoret staff of the Highlands Fertilizer Scheme co-operated in the investigational work and their co-operation was most appreciated.

The difficulty of working much of their land, its poor drainage and its exposure to erosion, the smallness of the holdings and the inferiority of communications continued to limit production. Five thousand nine hundred and sixty-seven bags of maize and 1,683 tons jaggery were sold by Indian farmers to Maize and Produce Controls: interest in sisal is becoming apparent and some plantings are being undertaken.

African Agriculture

Crops

The 1947 short rains planted crops were drought stricken at all stages of growth and failed. The consequent food shortage generally stimulated long rains plantings, and as conditions during the long rains season were favourable, production was greater than normal. As a result of the prevailing food shortage, a greater proportion than usual of early maturing food crops and of the longer term cereals (both green and dry) as well as nearly all the root crops, was consumed locally.

Coffee—Arabica—South Nyanza.

The handing over of services, including pruning and nursery upkeep, to the Growers Co-operative Society led to still further deterioration in standards of

cultivation and to a decline in the production of seedlings so great that supplies became totally inadequate to meet demands. Plantations, particularly of the large growers, lay couch-infested, bushes stood unpruned and shade trees, if not deliberately cut down, were allowed to die. Some progress was made in a couch eradication drive, but the crop had already been affected, and its quality was inferior. The Registrar of Co-operative Societies is assisting in attempts so to improve the organization of the Society as to enable it properly to carry out its functions.

Two hundred and fifty thousand one hundred and thirty-seven pounds of cherry were delivered to the co-operative pulping station in 1948, the corresponding figure for 1947 being 214,687 lb. The appended table gives comparative details of parchment coffee produced by the Kisii Growers Co-operative Society, Ltd., over the last few years:—

Pulping Station	*1945* lb.	*1946* lb.	*1947* lb.	*1948* lb.	*Total to date*
Kisii	4,908	15,353	7,104	12,813	40,178
Nyosia	—	10,477	1,905	5,543	17,925
Gesarara	—	6,378	3,244	7,338	16,960
Mugunga	4,050	3,123	3,132	6,064	16,369
Nyakigogi	—	3,145	6,447	3,744	13,336
Murumba	—	2,774	4,418	5,031	12,223
Marani	—	—	5,101	6,302	11,403
Nyankururu	—	3,507	1,922	2,809	8,238
Unmarked	28,080	—	—	—	28,080
Total	37,038	44,757	33,273	49,644	164,712
Buni unmarked					11,169
					175,881

Cotton.

1947–48 Season.—The area planted was estimated at 33,000 acres. Dry weather during harvesting led to improvement in quality of the cotton offered for sale and in the proportion of the crop which was harvested.

Purchase of Seed Cotton.

	"A" Quality lb.	*"B" Quality* lb.	*Total* lb.
No. 1 Area	3,546,692 ..	24,332 ..	3,571,024
No. 2 Area	472,781 ..	7,173 ..	479,954
No. 3 Area	772,806 ..	73,094 ..	845,900
Total	4,792,279 ..	104,599 ..	4,896,878

Price.

"A" Quality: 21 cents per pound.
"B" Quality: 7 cents per pound.

Production of Lint in Bales.

	A.R.	*B.R.*	*Total*
No. 1 Area	2,643 ..	14 ..	2,657
No. 2 Area	359 ..	4 ..	363
No. 3 Area	585 ..	50 ..	635
Total	3,587 ..	68 ..	3,655

1948–49 Season.—An early announcement that the high prices for cotton would be maintained, combined with active encouragement from the European and African staff of the Administration and the Agricultural Department in the areas most suited to cotton growing, led to considerably increased acreages of cotton being planted, particularly in the Nos. 2 and 3 areas. Marked improvements took place in standard of planting, in soil conservation and in after care of crop, though plantings were late and dragged on until August in some areas despite propaganda to the contrary. There were outbreaks of black arm and infestations of *Lygus*, and some loss of early crop in South Nyanza by stainers, but harvesting conditions were favourable and the quality of the crop picked was better than usual. Owing to dry weather during picking, yields will be below average though total production will show a considerable increase over last season. Marketing was opened in December but little had been bought at the close of the year.

Finger Millet (Wimbi).

Finger Millet suffered variously through early droughting and heavy rains at flowering and, except in Kericho where good crops were harvested from a large acreage, production was below normal. Once harvested, the internal demand for the crop was great and very little became available for export.

Fruit and Vegetables.

The production of fruit and vegetables for Kisumu, Nairobi and MacKinnon Road spread from the southern locations of North Nyanza to adjacent fertile areas in Central Nyanza.

In Kericho, markets for a surplus of cabbage could not be found and many went rotten; several growers were, however, persuaded to eat their unsaleable surplus.

Groundnuts.

A slight increase (mostly in Central Nyanza) in acreage is reported and harvests were good. Groundnuts are becoming increasingly popular as a food crop as distinct from a cash crop even in South Nyanza, while internal markets again absorbed almost the entire Central Nyanza and the small North Nyanza productions. All the seed issued in 1947 in Kericho as part of an attempt there to popularize the crop has been lost, mainly to children and stock.

Maize.

The acreage of maize planted increased considerably; growing conditions were generally favourable and good crops were harvested, even after a considerable quantity of green maize had been consumed. Substantial quantities of grain had come forward and were continuing to come forward for export at the close of the year. Short rains crops generally did badly.

Potatoes.

Potato production was maintained in South Nyanza, blight being prevalent. The small acreage in Kericho showed some increase, and fair yields of good quality tubers were being harvested and marketed at the end of the year.

Pulses, Including Beans.

Interest in the cultivation of pulses remains low in Kericho and most of North Nyanza. The long rains Central Nyanza and the early short rains South Nyanza plantings of beans, cowpeas and green gram yielded well, but later plantings were drought-stricken and failed. Nearly all the pulses harvested were consumed internally and very little found its way to Produce Control.

Too wet weather contributes to the unpopularity of pulses in Kericho, but the reason for that unpopularity in North Nyanza is not understood, production there in the past having been fairly considerable.

Rice.

Most production originated in North Nyanza, where about 7,000 acres were grown, yielding about 42,000 bags, 34,000 of which were purchased by local millers. Growing conditions in North Nyanza and on a thirty-acre irrigation project at Manga in South Nyanza, were satisfactory, reasonable crops were harvested and hopes are high for increases in acreage: elsewhere, interest was small, the available swamps dried out too quickly and most plantings failed. Little of the rice produced outside North Nyanza found its way to the miller.

Root Crops.

The value of cassava and sweet potatoes as famine reserve crops was suitably emphasized by the food shortages, which developed in many parts of the province in the first half of the year. Internal sales of African grown cassava, though reducing the supply available to Control, contributed materially to the avoiding of famine. Prices demanded from customers were high and in consequence, considerable acreages of root crop were established in widely scattered areas during the long rains: frequently, the acreage planted was restricted only by shortage of planting material.

Root crops generally grew well. Cassava mosaic was variable but caused little crop loss.

Except in Kericho where neither cassava nor the sweet potato variety which succeeds locally is liked, the areas where the available reserves of famine crops are inadequate are rapidly becoming less. Aroids are being introduced in Nyanza to add to the range of the available root crops.

Simsim.

Interest in simsim was virtually confined to North Nyanza, production in Central Nyanza and South Nyanza having fallen to a very low level for internal marketing. Interest in North Nyanza was maintained owing to the maintained increase in its selling price, but a shortage of seed which was rectified too late for planting in optimum conditions limited production; nevertheless a fair crop which will materially augment present seed supplies was harvested.

Sorghum.

The acreage planted showed a small increase, with interest rising in South Nyanza and declining in North Nyanza. After an uneven start the long rains crop did well and good harvests were reaped. Most of the crop was absorbed in the relief of food shortage and very little came forward for export.

Trees (other than Wattle).

The desire for trees and tree nurseries continues unabated in South Nyanza, where some millions of *Eucalyptus* and *Cupressus* seedlings were issued, most, unfortunately, to expire through ignorance and neglect during transplanting and establishment. In Kericho, interest is beginning to be taken in tree planting and new nurseries are being established here; young plantations are insufficiently tended and suffer badly from the depredations of stock.

Satisfactory plantings of *Cassia* at stake were carried out in the less well-treed areas of North Nyanza but shortage of funds limited similar work in Central Nyanza to a drive to collect seeds ready for setting out in 1949.

Nursery work continued in North Nyanza and (until the Maseno Farm was handed over to the Combined Training Centre) in Central Nyanza; at these nurseries successful introductions were made of seedling oranges and of Hawaiian pawpaw from Zanzibar, and of passion fruit from Kericho while the few plants of kola nuts from West Africa, and jack fruit from Gede which germinated did satisfactorily.

Wattle Bark.

Major export of wattle bark was confined to South Nyanza whence 1,060 tons, 910 of which were bought during the year, were exported. The bark there continued to be handled by unscrupulous traders who persuade growers to part with their mature plantations at nominal prices for stripping and conversion of the wood to charcoal. Deliveries were made throughout the year and the bark was usually mouldy and inferior in quality. War having broken continuity of plantings and the traders having skimmed the cream of the wattle business without passing to the grower any of the benefits of the present high price for bark, there is little enthusiasm shown towards replantings. All the mature trees in South Nyanza have now been felled and several years will pass before bark production can be resumed. Twenty bags wattle seed were distributed during the year.

In Kericho a small acreage under wattle was increased slightly, but interest in proper plantation management and, even at present high bark prices, in stripping continues to be difficult to arouse.

Wheat.

Wheat crops in South Nyanza and in the Sotik area of Kericho yielded normally to well. The bulk of the South Nyanza crop was exported but most of the Sotik crop was taken up by local African hotel keepers, who have no other sources of wheaten flour.

Produce Inspection

In Central Nyanza and South Nyanza, inferiority of staff, partly due to shortage of available funds, has restricted much needed improvements in standards of inspection. Nevertheless, past standards were maintained, grain generally was fair average quality and a start has been made in the introduction of grading screens. In North Nyanza and Kericho, the high standards of inspection in which these districts pride themselves were maintained, standards in parts of North Nyanza now being so high that Uganda drew its supplies of seed maize from African grown grain exported through Bungoma Station.

Too low standards of hide inspection in Kericho early in the year were rectified after the Inspectors had attended a hide inspection course kindly organized in Nairobi by the buyers, African Mercantile, Ltd.

Marketing

The marketing staff became stabilized during the year and were able more effectively to take over some of the duties connected with produce disposal which had previously been borne by agricultural staff.

The widespread food shortage diverted large quantities of foodstuffs into internal channels during the year and marketing was virtually at a standstill between April and August: thereafter produce was again offered in increasing quantities and at the end of the year buying was active. There was the usual friction between transporters and traders of the outlying markets of South Nyanza and the usual congestion there through inadequate provision of lighterage between the gulf ports and Kisumu. Otherwise marketing proceeded smoothly. Existing markets, particularly in the matter of grain storage, were improved and, in Kericho District, the opening of new markets is under discussion.

Interest in co-operative marketing increased, the co-operative marketing of eggs and poultry being particularly successful. There is an increasing tendency for traders from outlying markets to combine together and sell their produce direct to Control.

The maize price structure gazetted late in 1947 was maintained.

Incidents in cotton buying were limited to the usual allegations of dishonesty at buying post and proceeded smoothly.

QUANTITIES OF PRODUCE MARKETED IN 1947–48 WITH VALUE TO PRODUCER

Crop	Unit	Quantity		Value to Producer	
		1947	1948	1947	1948
				£	£
Seed Cotton	lb.	5,335,472	4,896,878	48,239	50,685
Maize	bag	672,044	446,468	317,038	252,611
Beans	,,	75	56	77	33
Cowpeas	,,	6,471	3,601	12,942	5,941
Green Gram	,,	2,955	2,583	5,910	5,166
Potatoes	,,	688	2,852	366	1,426
Simsim	,,	903	902	975	1,217
Groundnuts	,,	19,458	17,289	25,464	23,340
Rice paddy	,,	4,647	16,177	4,109	15,529
Sorghum	,,	9,822	13,674	4,052	6,153
Finger millet	,,	30,417	15,885	24,445	13,899
Wheat	,,	2,213	1,250	3,093	1,812
Coffee (cherry)	lb.	214,687	250,137	3,071	1,250
Firewood (Estimate)	—	—	—	12,000	14,420
Vegetables (Estimate)	—	—	—	8,500	12,000
Ghee	tin	30,177	22,295	36,248	56,119
Dried Cassava	bag	24,948	1,948	6,237	487
Eggs	No.	3,637,948	4,885,799	13,829	24,428
Poultry	No.	26,363	30,860	2,815	4,444
Field Peas	bag	—	196	—	205
C.W. Beans	,,	—	554	—	415
Wattle bark	ton	465	910	2,906	5,688

In the above table the 1947 value of coffee crop is the value of parchment sold by co-operative pulping stations while the 1948 figure is the value to the grower of cherry delivered to co-operative pulping stations.

Agricultural Betterment Fund

The following funds accrued to the districts during 1948:—

Description	Transport		Grade Betterment		Total
	Savings	Losses	Bonus	Cess	
	Sh. cts.	*Sh. cts.*	*Sh. cts.*	*Sh. cts.*	*Sh. cts.*
Maize (1–1–48 to 31–12–48)					
North Nyanza	135,726 43	—	333,574 22	810,420 55	1,279,721 20
South Nyanza	35,772 25	—	179,200 50	423,645 00	638,617 75
Central Nyanza	39,355 72	—	60,925 20	147,961 20	248,242 12
Kericho	7,620 84	—	49,886 49	120,642 57	178,149 90
Total Nyanza	218,475 24	—	623,586 41	1,502,669 32	2,344,730 97
Other Crops (1–1–48 to 30–9–48)					
Green Gram	1,308 85	—	—	—	—
Cowpeas	2,501 44	—	—	—	—
Simsim	495 02	—	—	—	—
Groundnuts	1,914 78	—	—	—	—
Wimbi	613 60	—	—	—	—
Mtama	—	1,461 08	—	—	—
Cassava	—	331 58	—	—	—
Peas	—	48 89	—	—	—
Beans	—	107 81	—	—	—
Made up of:					
North Nyanza	514 25	—	—	—	4,884 33
South Nyanza	3,810 59	—	—	—	—
Central Nyanza	559 49	—	—	—	—
					£2,349,615 30

GRAND TOTAL .. £117,480 15 30

Schemes are in operation for the use of Betterment Fund moneys for subsidizing and fostering the use of manure, for improving livestock, for tree planting and afforestation, for soil conservation and for improving water supplies.

Famine Relief and Prevention

The food shortage in 1948 developed as a result of the failure of the 1947 short rains, started in April and continued until early planted quick growing cereals and green maize became available, in late June in the early areas and in August in the late areas.

Kericho, where food shortages were minor and local and were met by internal movement, was the only district in which provision of famine relief was not needed. In Central Nyanza, even though the food shortage was widespread, it proved possible to limit provision of relief to the normal making available of food at controlled prices to the lake shore people and to the offer of maize meal in part payment for work on dam construction. Sale at controlled prices of relief foodstuffs to the extent of 1,858 bags maize and wimbi was necessary both in the highland and lake shore areas of South Nyanza. The food shortage was most acute in North Nyanza, where 19,133 bags of food, mostly maize, were sold at controlled prices. Considerable internal movements of cereals and roots from surplus producing areas to areas where food shortages were felt contributed greatly to alleviate what threatened to be a famine.

Danger of future famine was met by widespread plantings of cassava and sweet potatoes, by the introduction of aeroids, by developing rice production in suitable areas and by the provision of strategically situated grain storage. Cassava planting in places was, however, sadly restricted owing to local shortage of sticks, adjustment of which is in hand. The famine crop position is least satisfactory in Kericho, where virtually no root crops have been planted.

Crop Improvement and Investigations

Activities in crop improvement were limited to routine mass selection work, bulking of planting material of famine crops, a limited number of variety trials and the starting of collections. In particular, work was instigated with a view to standardization of rice production on the two or three best local varieties by selection from the mixed assortment now offered for sale by the grower. Trials were also carried out on a wide basis on Njoro seed hybrid maize varieties, and on soya beans, cotton, wheat, sorghum and potato varieties and on local and introduced grasses.

Seeds issued during the year include:—

181 bags groundnuts.
4½ bags wheat.
20 bags green gram.
2 bags beans.
18 bags cowpeas.
3 bags rice paddy.
20 bags wattle.
22 bags potatoes and sundry vegetables, grasses and fruits.

Introductions were made (*a*) of fibre crops to meet the world jute shortage: of those under trial, sunn hemp did well everywhere, *Urena lobata* though indigenous, did not succeed under cultivation while *Hibiscus diversifolius* also was unsuccessful; and (*b*) of oil crops to meet the world fat shortage; of those under trial, niger and safflower, though behaving unevenly, generally did well, various varieties of soya beans behaved unevenly but generally poorly while the ceiling for groundnuts in South Nyanza was fixed at 4,700 ft., niger there doing best above that altitude.

Trials of fodder crops and trials aimed at diversification of the food and cash crops of the local cultivators continue. Varieties of hybrid maize which were tried out in various parts of the province failed.

Fertilizer trials were continued at Kakamega, Bukura, Maseno and Kisii: subject to confirmation by statistical methods, results are believed to have been inconclusive. Arrangements have been finalized to extend fertilizer work in 1949 comprehensively to cover conditions prevailing in the province.

Departmental Farms.

Departmental Farms were maintained at Kakamega, Bukura, Kisii, Kericho and, until October when it was handed over to the Combined Training Centre, Maseno. Amalgamation of the agricultural and veterinary farms at Kisii has been approved in principle and details of the operation have been worked out.

At Kakamega, all cultivation was protected with broad based terraces, including an area run co-operatively by the station staff for their own needs. Active production and use of compost was initiated. The too great stock population on the farm was reduced, the remaining beasts being given supplementary feed of sweet potato tops and edible canna, on which they thrived. Sweet potatoes were used also to help eradicate star grass infestation of much of the arable.

Activities at Maseno were in preparation for its handing over: a further seventeen acres were brought under cultivation, a citrus nursery was established and the site was pegged out of a dam having dual functions of providing improved access to the school buildings and of providing water for a vegetable garden further down the valley.

Steady progress was made at Kisii in building up a flock of Rhode Island Reds imported strain.

Yields at Bukura for the long rain plantings were:—

Maize: 6¼ bags per acre.

Mtama: 4½ bags per acre.

Wimbi: 1¼ bags per acre.

Groundnuts: 8 bags per acre.

Progress of Improved Farming

The great step forward during 1948 was the initiation of twenty-seven group farms with a membership of 420 and control of 8,700 acres. African interest in the movement is keen and in many areas further extension is limited only by shortage of suitable staff: this against the existence of one group farm (Nyahera) only of fourteen members at the beginning of the year. Established groups have withstood the disruptive activities of local agitators and have shown themselves responsive to enlightened advice; great hopes are held for the consolidation of most established group farms.

The Group Farm System is aimed at the adaptation of indigenous control of land usage to meet the full and intensive production demanded by a growing and advancing African society and at the same time to maintain a high standard of soil fertility. The present system of land tenure, the inadequacy of equipment available to the cultivator, the unsatisfactory location of most boundaries between holdings and the haphazard distribution of cultivated, grazing and the residential areas springing from the individualism of the land holder have all contributed to the low productivity, the declining fertility and the erosion of African cultivated soils.

On group farms, while individual title to land can be retained, soil conservation measures laid out with a view to satisfactory drainage and cultivation operations planned with a view to maintenance of soil conservation works are facilitated; land may be apportioned in a co-ordinated manner, with reasonable access provided to grass lands and cultivation, and with rational allocation of land to timber; and units being larger, thorough mechanical cultivation of arable land and effective dipping of stock become possible. Furthermore, the

co-operation which group farming necessitates can be extended to the contacts of the members with the outside world when buying their supplies and marketing their produce and in civic affairs to their contacts with the administrative and technical officers of Government.

Each group farm comprises a number of families usually related one to another, who, at the instigation of one of their leading members, agree among themselves to co-operate in their farming activities. Each group farm is contour-terraced and is subdivided into habitation, cultivable, permanent grazing and timber areas in accordance with the best use to which the land can be put. The cultivable land is subdivided along the contours into as many nearly equal strips as the rotation adopted requires, the provisional intention being that the area of cultivable land at any time under grass shall equal the area under arable crops. All permanent grazing will be communally managed, subdivided and grazed rotationally.

In all preparatory cultivation, the area under cultivation will be cultivated as a unit, but for manuring, sowing, weeding, harvesting the old boundaries between holdings may, in the absence of agreement between members to the contrary, still be followed. Assistance with mechanical terracing is provided to each group on formation, but further assistance thereafter is conditional on maintained good progress; the ultimate aim is cultivation by co-operatively-owned or hired equipment.

The cultivable area at any time under grass will be grazed rotationally while, again, in the absence of agreement to the contrary, the old boundaries (within the strip at any time being grazed) between holdings will be followed. The aim is stock improvement, made possible by dips and superior bulls, owned jointly if necessary by a number of group farms. Provisions of supplementary stockfeed and passage of all crop residues through the stock pens and their conversion to manure are essential aspects of the completed scheme, though manure production at this early stage is remaining an individual activity of each member.

Absent members retain title to their land but its usufruct passes, during the period of their absence, to the remaining members of the group.

Management of each group is vested in a representative and authoritative committee of its leading members. The particularly good progress in group farming in Central Nyanza was most heartening, for attempts to secure progress in mixed farming through other channels there met with continued obstinacy. In other districts, the value of manuring is now appreciated by a relatively small but growing community: assistance in moving manure under a popularization scheme in South Nyanza was welcomed, particularly by the Luo who paid for over 100,000 barrow loads; extension of the scheme was limited only by shortage of equipment. In North Nyanza, manure collection and compost making has so spread that established units now have a production potential of some 4,000 tons compost per annum. In Kericho, some cultivators have been persuaded and assisted to manure their holdings. Dung and trash burning, however, everywhere continues to be far too prevalent while tree planting to provide other source of fuel in the less well timbered areas proceeds far too slowly.

Some diversification of crops with increasing popularity of sweet potatoes and an incipient interest in grass leys is apparent in North Nyanza and some slight interest in the fodders lucerne, edible canna and maize silage is developing in Kericho.

Improvements in standard of cotton cultivation have been secured in North Nyanza and South Nyanza and of cultivation and water control in rice in North Nyanza.

Zoning of crops was started with the adoption of a policy of restricting cotton production to the most suitable areas, as decided by a Commission of Inquiry into the industry held early in the year.

Soil Conservation and Fertility

Though lip service to the need for soil conservation is now general, the attitude towards active measures to control the scourge remains apathetic. Thus, the densely populated southern locations of North Nyanza had a total output of 365,486 yards narrow-base terraces and the corresponding figure for the whole of Central Nyanza was 130,720 yards, together with 300 acres protected by store terracing—outturns per head of population in the region of one yard per year. Narrow-base terracing in South Nyanza was confined to demonstration in the lower areas, using communal labour: further progress there was limited by lack of line levels and shortage of proficient staff and too often the terraces, once constructed, were trampled out of existence by the local stock as they wandered uncontrolled through the fields after harvest. Most terracing was done communally, but generally the turn-out was poor and confined to older men.

Other conservation measures particularly the use of trash lines in Kisii Highlands and of contour grass strips in Kericho District, have proved more attractive and good progress has been made in their extension and improvement.

Little terrace maintenance work can be reported other than the clearing out and restoration to good working order of the broad-base terraces constructed mechanically in Kitosh in 1942. Ploughing on the contour is at last becoming common practice, though frequent prosecution has been necessary in Central Nyanza.

An excellent bite was secured in the dry weather early in the year on areas in Kericho District which were closed to grazing in 1947; in consequence stock owners were much more sympathetic to grazing closure during 1948 and the acreage so treated showed a considerable increase. In Central Nyanza, some 350 acres of bare land were fairly effectively closed while a grass planting week in April, aimed at the reclamation of such areas, was very successful: the reopening of most replanted grassland to grazing was, however, effected far too soon. Grazing closure and grass planting on the present scale is a pitifully inadequate palliative and overstocking, which is the real problem, in most areas becomes increasingly acute. New areas are being opened up, or are being considered for opening up, by tsetse fly clearing and by the provision of improved water supplies, but even in such areas attempts to secure proper grazing management encounter continuous opposition, while no progress has yet been secured in culling. A census in Kericho District revealed a cattle concentration over all the available grazing of four beasts to every five acres, while additionally most graziers have several donkeys and large herds of sheep and goats. There is still a general persistence in grass burning late in the dry season with the object of securing an early bite during the rains. Many badly worn cattle tracks were successfully closed and, where necessary, regrassed.

In South Nyanza a start was made in the establishment of tree plantations along the contour.

Mention must again be made of the excellent co-operation of the Location Committee of Belgut (Kericho District) in soil conservation matters.

Dams and Water Supplies.

Improved progress was made in the provision of dams and water supplies, ten earth dams being under construction during the year, six of them being completed. A concrete weir intended to impound water in the Bukiria River (South Nyanza) failed owing to failure to seal the impounding basin. Several other dams were cleaned, improved or repaired.

Despite the acknowledged benefits of improved water supplies and the lavish provision of equipment, communal enthusiasm for dam construction work refused to be roused and nearly all the progress reported was secured by paid labour.

Education

African Agricultural Training School, Bukura.

Senior Students—

Full year	29
Half year	2

Two failed to complete the course satisfactorily.

Junior Students	20

All are of primary school standard and promise well.

Teacher training (1-year course)	5

In addition to the full courses, three short refresher courses, concentrating on soil conservation technique, were given to sixty-four Instructors from North and Central Nyanza, and from Rift Valley Province: the standard of work of instructors at the end of these refresher courses was generally good. The football season was highly successful.

Two European houses, one of which is to house the East Africa High Commission Field Officer i/c Fertilizer trials Nyanza Province, are now ready for occupation but a satisfactory water supply for them is still lacking. A borehole for the farm, sunk to nearly a hundred feet, produced only some fifty gallons an hour while the existing ram yields a mere 200 gallons a day and the houses now have to rely on ox transport from a stream. The first of three blocks of African double quarters is under construction.

The change-over to a demonstration group farm took a step further by the terracing with graded broad based terraces of the 75 acres being so developed. Small Rhodes grass and molasses grass pastures were established as part of the programme for improving the present generally poor grazing and the inferior stock carried thereon: real improvements in stock, however, await provision for tick eradication.

Social Welfare.—The local native council spinning and weaving centre recovered from its recent depressed condition and was well attended most of the year, great interest being taken in the spinning of cotton owing to its more ready accessibility than wool. The welfare worker was able to give regular well attended programmes with his 35 mm. film strip projector.

District Education.—Whenever possible, advisory visits were paid to schools by both European and African staff, but the amount of time available for this work is far too small and the standard of agricultural education given in all grades of schools remains low.

Agricultural doctrine was disseminated through all the channels operated by local welfare and information services and through the local press.

Educational visits were arranged, to eastern Uganda for selected cotton growers in North Nyanza, to Bukura Farm for group farmers from Central Nyanza and to Machakos for Kericho elders, to Kisii Farm for pupils of Kisii African Secondary School and, regularly, to Kakamega Farm (to study each time some selected aspect of farming enterprise) for pupils of Kakamega African Secondary School; unofficial visits to Government farms were also encouraged.

Agricultural Shows.—Thanks to the efforts of field officers, particularly those of Kericho District on whom the burden of preparation and organization fell most heavily, a highly successful Provincial Show was held at Kapkatet. At the show, educational exhibits by all departments interested in African development and welfare, competitive exhibits by districts and by individuals, trade exhibits and competitive events all featured. The occasion was graced by the presence of H.E. the Governor and other high Government officials and was attended by large numbers of Africans from all districts. South Nyanza scooped the bulk of the awards for exhibits, together with the produce Challenge Cup and the Native Industries Challenge Cup, while Kericho won the District Cup.

Successful local shows were held at divisional centres in South Nyanza in preparation for the district's effort in the Provincial Show and a small location show at Malakisi was a most creditable effort. Nevertheless much effort is still needed to educate the African to a proper appreciation of the value of shows and of the standards of competitive exhibits.

Communications

Main roads generally were maintained in good condition while minor roads were usually passable. There were, however, the usual washaways of bridges and the usual delays in effecting their repair.

Pests and Diseases

Locusts.—Nil.

Pests and Diseases of Cereals and Grasses.—Army worm was widespread. Damage inflicted by the pest to grazing in Kericho contributed to a high mortality there of stock through shortage of grazing early in the year. Early cereals also were badly infested in most areas, necessitating considerable replanting, alleviation of the food shortage being correspondingly delayed. The infestation disappeared as soon as the long rains set in.

Stalkborer was widespread in Central Nyanza while a threatened attack on the slopes of Mount Elgon was controlled by dusting with DDT in diatomite. Pink ear rot of maize was reported from Kericho District. Leaf stripe of maize was reported from Central Nyanza in the short rains plantings. Head smut was severe only in ratooned sorghums, where it was prevalent. Striga infestation of sorghum continued to prevail in Luo country despite continued pressure for its eradication. A leaf mining beetle destroyed much of the rice crop in Central Nyanza.

Pests and Diseases of Coffee.—(South Nyanza only).—*Antestia* incidence was low during most of the year but increased sharply in November, as the coffee matured. *Hemelia* was slight and restricted to debilitated bushes. Berry disease was negligible.

Pests and Diseases of Cotton.—Black arm was generally severe and caused much loss of early crop. *Lygus* infestation was heavy, particularly in the higher parts of No. 2 and 3 areas. Stainers were variable but generally low until late in the season, except in South Nyanza where they caused much loss of early crop. Boll worm and *Helopeltis* were reported as damaging bolls in North Nyanza.

Other Pests and Diseases.—Cassava mosaic was fairly widespread but the crop loss caused was small.

Noxious Weeds.

Datura stramonium.—Eradication campaigns continued unremittingly, but the infestation shows no sign of abatement.

Vermin.

Pigs, monkeys, baboons, porcupines and hippopotami featured among the vermin which have damaged crops and hyena have killed many stock in Sotik. Vermin poisoning was carried out where most necessary, except in North Nyanza where poisoning groups have not yet been revived.

Conclusion

A difficult year with progress impeded by drought, food shortages and continual disinclination of the African community to shoulder its responsibilities towards the land on which it depends. Nevertheless, that there is hope for the future is shown by the successful establishment of some group farms, by the demand for manure which is becoming apparent and by an increasing awareness of the unsatisfactory nature of present methods and of the value of our advice. The spread of such enlightenment will depend on the continued hard work and co-operation of all concerned.

P. C. CHAMBERS,
Senior Agricultural Officer.

ANNUAL REPORT OF THE SENIOR AGRICULTURAL OFFICER, RIFT VALLEY PROVINCE, 1948

Staff

European:

Nakuru.—Mr. R. E. T. Hobbs took over the duties of Senior Agricultural Officer, Rift Valley Province, on his return from overseas leave at the end of January and was in charge of the provincial work. Mrs. M. R. Rennie, Temporary Clerk, proceeded on overseas leave in the middle of November and Mrs. Lewis was appointed to the post on 13th December. Mr. H. Moraes was transferred from the Plant Breeding Station in March for part-time duty, two days a week being spent at the Plant Breeding Station. He was, however, ill with typhoid during July/September and after resuming duty for a period in October proceeded on sick leave until the middle of November.

Njoro.—Mr. F. H. Ormerod, Agricultural Officer, was posted to Kitale in April and Mr. W. G. Freeguard, Assistant Agricultural Officer, took over from him. Mr. Freeguard proceeded on overseas leave in December and Mr. A. Storrar, Agricultural Officer, was posted to Nakuru on the 13th December, the office of the Agricultural Officer being moved from the Plant Breeding Station to the Provincial Office in Nakuru.

Ol Joro Orok.—Mr. G. R. Henderson, Agricultural Officer, took up his duties at the beginning of the year doing district agricultural work in the Thomson's Falls, Rumuruti, North Nyeri and Naivasha-Kinangop areas, in addition to experimental work on the Ol Joro Orok Station. Mr. L. R. White, Assistant Agricultural Officer, was in charge of the Ol Joro Orok Experimental Station.

Kitale.—Mr. F. H. Ormerod, Agricultural Officer, was posted to Kitale in April to take over charge of the Kitale Experimental Station and the district agricultural work from Mr. J. T. T. Schouten, Assistant Agricultural Officer (Coffee), thus relieving him of these additional duties. In October Mr. Ormerod was transferred to Nairobi and Mr. H. T. Lloyd was appointed Assistant Agricultural Officer, Kitale, on his return from overseas leave, in November. Mr. J. Wolff, Field Assistant, who was managing the Waterkyn Farm under the supervision of the Agricultural Officer, Kitale, resigned on the 30th November, 1948, and Mr. Patridge was engaged as manager on the 1st December, 1948.

Eldoret.—Mr. L. N. R. Strange, Assistant Agricultural Officer, worked in the Uasin Gishu district throughout the year and in addition to his agricultural duties acted as Executive Officer to the Uasin Gishu Man Power and Production Committee.

Tambach.—Mr. W. M. Spencer, Assistant Agricultural Officer, living at Chebiemet, was doing general agricultural work in the Elgeyo/Marakwet native reserve.

Kapsabet.—Mr. M. Sholto Douglas, Assistant Agricultural Officer, remained in charge of the Ndalat Scheme and did general agricultural work in that area of the Nandi reserve. When the Assistant Agricultural Officer moves to Kapsabet he will take charge of all the agricultural activities in the Nandi reserve.

Kapenguria.—Mr. D. C. Rennie, Assistant Agricutural Officer, was in charge of general agricultural work in the West Suk native reserve and various schemes financed by the African Settlement and Land Utilization Board.

Kabarnet.—Mr. J. L. Wordsworth, Assistant Agricultural Officer, who was in charge of the agricultural work in the northern area of the Kamasia reserve, was admitted to the European Hospital, Nairobi, in November, and the post remained vacant until the end of the year. The District Commissioner, Kabarnet, kindly assisted in the supervision of the African staff and the carrying out of routine work.

Esageri.—Mr. R. A. Langridge, Assistant Agricultural Officer, who was in charge of the Esageri and Solai Border Schemes, resigned on the 21st January, 1949, and was replaced by Mr. I. MacLeod, Assistant Agricultural Officer, who was transferred from Konza on the 5th January, 1949. When these two schemes are properly established it is proposed to start general reconditioning work in the Southern Kamasia reserve as the two schemes are bound up with this. Mr. MacLeod will take charge of this work also.

Maralal.—Mr. W. A. Davidson, Assistant Agricultural Officer, remained in charge of the grazing control in the Leroghi Plateau and did advisory work on grazing control in the low country of the Samburu reserve.

African:

European areas.	Clerks	3
	Field Assistants	5
	Produce Inspectors	8
Native areas.	Clerks	Nil
	Agricultural Instructors (Departmental) ..	20
	Agricultural Instructors (L.N.C.)	54
	Grazing Guards	12

Travelling

18,335 miles were covered by the Senior Agricultural Officer on official duty during the year and 101 nights were spent on safari. In addition several trips were made to Nairobi in connexion with the Stockfeed Rationing Committee.

Meetings

Meetings of the Production and Man Power Committee, the Flax Board, The Seed Growers' Association, the K.N.F.U. and Regional Water Boards in the province were attended whenever possible.

Visitors

A number of overseas visitors were interviewed and when possible shown round the province during the year. Amongst these were Mr. A. N. Duckham, C.M.G., Agricultural Attaché in Washington; a Northern Rhodesia Farmers' Delegation; Mr. T. A. Oxley from the Colonial Office and M. Durocher Yvon, Assistant Director of Agriculture, Seychelles.

Tours were arranged for the students of the Egerton School and parties were shown around the experimental stations.

Seasonal Conditions

After a false start in March the long rains did not start properly until mid-April and plantings of maize were consequently delayed. From then on, rains, although lighter than normal, with the exception of the areas affected by the short November-December rains, were excellent for crop growth and record yields of maize and wheat have been harvested. When the rains ceased at the end of November the dry season set in very rapidly, which, although conducive to a good harvest, did not help grazing. The most abnormal rainfall in the province was at Wamba situated in the lower areas of the Samburu reserve, where 66 inches were recorded as against an average of 18-20 inches, most of this falling in the short November-December rains.

Experimental Stations

Ol Joro Orok.—Very satisfactory progress was made in the development of this station during the year. Most of the implements necessary for the running of the station have now been obtained and the opening up of a timber concession and a stone quarry in the forest adjoining the farm meant a free supply and effected economy in building and fencing materials. Bull-boxes, implements, sheds, workshops, dairy and milking stalls and a 100,000-gallon water storage tank have been

completed during the year and pig sties are at present under construction. Expenditure, excluding capital expenditure under the Colonial Development and Welfare Vote, and revenue for the year were as follows:—

Capital.		*Sh.*	*cts.*
Implements		13,514	76
Building and water supplies		5,572	89
Fencing		793	00
	Sh.	19,880	65
Running.			
Manures, seeds, sprays		1,199	32
Repairs, renewals and small tools		4,916	89
Feeding stuffs and veterinary upkeep		2,724	25
Fuel, oil and lorry transport		9,594	91
Miscellaneous		510	25
Labour		8,591	27
Rations		4,011	40
	Sh.	31,548	29
Revenue.			
Sale of butterfat		1,448	63
Sale of milk		1,417	92
Sale of wheat		21,846	00
	Sh.	24,712	55

Kitale.—Water supplies to all fields were completed during the year and fencing of all paddocks completed. The farm can now be considered fully developed and all that is required is the provision of European housing and permanent labour lines. Artificial insemination has been carried out on the dairy herd using sperm of pedigree Guernsey bulls from the Central Insemination Centre at Kabete and the average number of inseminations per calf during the year has been 2.6 which is very satisfactory.

Expenditure and revenue for the year were as follows:—

Capital.		*Sh.*	*cts.*
Buildings and water supplies		3,941	78
Fencing		115	80
Labour and rations		1,500	00
	Sh.	5,557	58
Running.			
Manures, seeds and sprays		1,327	45
Repairs, renewals and small tools		2,559	06
Feedstuffs and veterinary upkeep		3,318	93
Fuel, oil and lorry transport		3,298	53
Miscellaneous		620	37
Labour		12,947	68
Rations		1,659	08
	Sh.	25,731	10

Revenue.

Sale of pigs	12,575	50
Sale of coffee	10,785	62
Sale of butterfat	4,618	82
Sale of Milk	1,185	26
Sale of livestock	1,701	40
Stock transferred to other stations (Estimated value)	10,680	00
Sh.	41,546	60

Naro Moru.—It is hoped to commence work on the development of this station in 1949. Plans and proposals for water supply were prepared during the year and overhead spray irrigation equipment ordered.

Eldoret.—The land, comprising some 400 acres, has been set aside for this station but funds have not yet been provided for its development. A detailed contour plan showing the proposed lay-out of the farm was prepared during the year and lines for windbreaks have been marked out.

Production

European Areas

Crops:

Barley.—An increased acreage of this crop was planted during the year, mainly for pig feed and malting purposes and yields have been above average. Acreages and yields for the combined districts for the three years 1946–48, the yield for the last year being an estimate, are as follows:—

Year	*Acreage*	*Yield per Acre*	*Total*
		bags	*bags*
1946	7,778	5.0	39,054
1947	9,698	5.2	50,847
1948	12,315	6.9	82,972

The main acreages of barley are in the Nakuru and Naivasha areas and acreages have increased in 1948 in both these districts.

Flax.—With the exception of two small areas in the Uasin Gishu and Molo, comprising between them about 500 acres, the production of this crop for fibre purposes has practically ceased. Two Flax Board factories have been operating during the year and a like number of private factories. A spinning plant has also been started on Elgon and it is probable, when this is finally completed that it will absorb all the local production of fibre.

Linseed.—On account of price and propaganda there has been a considerable increase in the acreage planted to this crop this year; exact figures are not available but the total acreage is probably in the region of 6,000–8,000 acres. Yields, in the higher areas, which are more suited to this crop, have been from 4–5 bags per acre. Owing to the need for a fine seed bed and the fact that the optimum time for planting coincides with the heaviest rains, it is not a crop which can be recommended in all areas on account of the danger of soil erosion and it is improbable that the acreage will ever increase much above its present level on this account.

Maize.—The maize acreage has increased slightly in all areas, the largest increase being in the Nakuru area, where an increase of 50 per cent is recorded. It has been a most favourable year for this crop and yields are above average. Acreages and yields for the combined districts for the three years 1946–48, the yield for the last year being an estimate, are as follows:—

Year	*Acreage*	*Yield per Acre* bags	*Total* bags
1946	92,480	7.4	681,862
1947	91,450	7.3	664,302
1948	105,315	8.1	857,421

The bulk of the maize is grown in the Kitale, Nakuru and the lower areas of the Uasin Gishu and it is probable that up to half of the total amount produced will be retained on farms for use as rations for labour or for stockfeed.

Oats.—The acreage under this crop has increased considerably this year and yields have been above average. With the increased yield, however, quality has suffered and it is difficult to find samples of good enough bushelling quality to qualify for the bonus on milling from this season's crop. The new feed oat Achilles has yielded well in all areas. Acreages and yields for the combined districts for the three years 1946–48, the yield for the last year being an estimate are as follows:—

Year	*Acreage*	*Yield per Acre* bags	*Total* bags
1946	4,473	6.0	26,518
1947	7,791	4.8	37,199
1948	13,264	6.7	89,548

Potatoes.—The acreage of this crop grown by European farmers is not large and with the lifting of control and the consequent drop in price, has tended to be restricted to seed production and the planting of small acreages to catch the out-of-season market. The blight resistant varieties such as "914" and Dutch Robyjin have given good yields on the Kinangop.

Pyrethrum.—With the decrease in price at the beginning of the year large acreages of this crop were ploughed out, farmers tending to leave only fields of the high toxic variety for future expansion if the price proved satisfactory. As an indication of the drop in acreage under this crop figures for the Nakuru district may be given which show a decrease from 22,766 acres in 1945 to 2,154 acres in 1948; whilst this reduction in acreage means a loss of farm income yet, to quote the Agricultural Officer, Nakuru—"the land will benefit accordingly as it was rapidly denuding the producing areas of fuel and soil". The effect of the increase in price and the prospects of a stabilized market during the latter half of the year has tended to arrest the decline in acreage and new plantings with high toxic strains are now taking place. Even with the present price, however, taking into consideration the costs of production, especially labour, the crop does not compare favourably with cereals, except in those areas where average yields of 600 lb. of dried flower per acre and over are obtained.

Sunflower.—The acreage of this crop sown for the production of seed, as distinct from a green manure, shows a considerable increase as the following acreage figures for the combined districts show:—

1947 — 4,702 acres.
1948 — 11,926 acres.

This increase has been brought about partly on account of the increased price of oil cakes for stockfeed and the increased use of home-grown sunflower head meal for this purpose, and also, mainly on account of the high price offered for export. The main producing areas are at present the lower areas of the Nakuru and Uasin Gishu districts and the Trans Nzoia; in the latter area yields of up to 20 bags per acre have been obtained on Elgon. With the introduction of semi-dwarf varieties, trials so far indicate that the area in which this crop can be grown can be considerably extended and if combine harvesting of these varieties proves successful, and there are indications that it will, it should prove a useful crop for rotation with wheat in the higher areas.

Tea.—The last two years have seen a rapid development in the Nandi tea-growing area. The area which is suitable for tea comprises approximately 60,000

acres lying above the Songhor escarpment. The altitude is 6,800–7,000 ft., and rainfall 55 to 65 inches per annum. Of this total area there is a potential tea acreage of about 18,000 to 20,000 acres. Of this, about 5,000 acres should be in production in about eight years' time, and about 10,000 acres in twelve years' time. The cost of bringing this 10,000 acres into production is estimated at between 1¼ and 1½ million pounds. There will be an annual expenditure of roughly £250,000 to £300,000 when the tea is in production. The cultivation of this acreage will be done by seven to ten large companies and fourteen to twenty private individuals.

Wattle.—Activities in regard to this crop are mainly confined to the Uasin Gishu where the acreage has risen from 18,632 in 1947 to 29,037 in 1948. This rapid increase is in part due to the East African Tanning Extract Co. Ltd, who, in addition to establishing plantations of their own, have erected an extract factory near Eldoret which will commence operating in 1949 and deliveries of bark from farmers are already being accepted.

Wheat.—The acreage under this crop shows a considerable increase, most of which is accounted for by the Laikipia-Naivasha area which shows an increase in acreage of 35 per cent over 1947 and where the continuance and increase of one-crop wheat farming is causing concern, which will be commented on in a later section of this report. This has been one of the most excellent wheat years on record and yields and the total crop are the highest ever produced. Stem rust has been more prevalent than in former years and individuals who planted non-rust resistant varieties have suffered loss. The following new varieties of wheats from the Plant Breeding Station have all shown considerable promise: 294M.7.C.6.A, 294B.2.A.3, 318A.J.4.A.1 and 261R.7.C.1.B. Acreages and yields for the combined districts for the years 1946-48, the yield for the last year being an estimate, are as follows:—

Year	*Acreage*	*Yield per Acre*	*Total*
		bags	*bags*
1946	186,909	4.2	781,788
1947	188,939	3.7	704,899
1948	207,151	4.9	1,034,063

Miscellaneous Crops:

Phormium tenax.—The position is little changed from last year. Two farmers have imported, and will shortly be operating, their own decorticating machinery. There is a slight increase in acreage. Some of the *Phormium* recently planted by private individuals is not making very good growth and there is still much to be learned regarding the cultivation and handling of this crop.

Niger oil.—Plantings of this crop must be considered to be in the experimental stage. A number of farmers have tried small patches and the crop would appear to succeed over a wide range of altitudes and is a hardy grower. Some difficulty has been experienced with regard to harvesting and it is not yet certain whether it can be done efficiently with a combine harvester. Yields have proved rather disappointing and about two bags per acre would appear to be the average.

Seed production.—The production of seed of peas, kidney beans and other varieties of vegetable seeds and flower seeds for export is proving a useful side-line to a number of farmers, the interests being looked after by the Seed Growers' Association. Some 200 field inspections of crops of wheat, oats and barley were carried out by officers of the department during the year for purity and trueness to type and samples submitted on harvest to the Scott Agricultural Laboratories for testing for purity and germination, seed certificates being given for those of the required standard.

Livestock:

Butterfat.—Deliveries to all creameries continue to increase and the recent increase in price should prove a further stimulus to production. The demand for

dairy cattle is far in excess of supply and prices, in many instances, have tended to be uneconomic. Annual totals of pounds of butter manufactured by the Kenya Co-operative Creameries for the past five years are as follows:—

1944	4,404,869 lb.
1945	5,116,054 lb.
1946	5,724,613 lb.
1947	6,336,030 lb.
1948	5,725,724 lb.

Pigs.—The production of pigs is still behind the capacity of the bacon factories; this is due, partly, to a severe shortage of animal protein feed in the main maize-growing areas early in 1948 and partly to a shortage of cereal feeds in the latter part of the year due to a short crop in 1947 and many farmers reduced their breeding stock during these periods. The shortage of animal protein feed has been met, to some extent, by the provision of a mixed protein meal but there is no doubt that the most economical protein feed, and the one which produces bacon pigs of the best quality, is skim milk; at present this is produced in quantity under conditions of ranch dairying at one end of the country and cereals are produced at the other and until the main cereal-producing areas change over to a much greater extent to mixed farming, with a basis of dairying, they will continue to suffer from shortage of suitable protein feed for pigs.

Meat.—The production of beef is mainly confined to the ranching areas of the Rift Valley, to the Rumuruti area and to the Cole Plains. With the exception of certain areas around Naivasha good rains fell in all these areas during the year which, combined with the excellent rains in 1947, have provided a thick grass cover and stock are in good condition.

Sheep, both mutton and wool, continue to play a large part in the farm economy in the higher areas, especially Molo, and the high prices received for the wool clip have made them an extremely profitable proposition.

African Areas

Before dealing with the production of the African areas of this province it should be stated that the general policy is not to encourage the production of cash crops, the aim being to ensure that each area is self-supporting in food. Most of the tribes are semi-pastoralists and most of the reserves are overstocked with cattle, sheep and goats. It is considered, therefore, that the main cash income of these tribes should be derived from the sale of stock and stock products, preferably meat and hides.

Crops:

Maize.—In the native reserves of Nandi, West Suk and Kamasia and the middle elevations of Elgeyo the crop has yielded better than last year. The higher areas of Elgeyo are unsuited to the crop and yields are poor. In the lower areas of Kamasia the crop failed due to drought. The only two areas which will produce any surplus are parts of Nandi and the Mnagei area in West Suk; in the former area the surplus is being purchased by the Maize Control and in the latter area the surplus is being retained in the reserve and, if not required there, will be disposed of to the pastoral tribes of Turkana and Karasuk.

Sorghum.—This crop is the staple cereal in the valley areas of Elgeyo and the lower areas of West Suk. It is normally grown under irrigation and two crops a year are obtained. A trial area of Dobbs was tried this year in West Suk and gave a very good crop, without irrigation, on 12 inches of rain.

Potatoes.—These are a popular crop at the higher elevations in the southern end of the Elgeyo reserve and there is a considerable export of them from here to local markets in Eldoret. There is a considerable demand in this area for seed of blight-resistant varieties and supplies are being bulked at Local Native Council demonstration plots.

Finger millet.—Yields of this crop have been above average and the acreage is tending to increase again after declining in recent years, partly due to its being replaced by maize and partly due to propaganda and compulsion in preventing forest destruction and the cultivation of steep slopes, which provided the favourite sites for millet shambas.

Miscellaneous Crops:

Pulses.—Various types of these are grown in small quantities and are consumed locally.

Groundnuts.—After a number of years of propaganda small areas of this crop are now grown in the lower parts of West Suk and Elgeyo. The harvest is consumed locally and makes a valuable protein addition to the diet, especially as it is grown in those areas where the keeping of stock is prohibited owing to the presence of tsetse fly.

Cassava.—Planting material of this crop is being bulked in plots in the lower areas of the reserves in preparation for extended plantings as a famine prevention measure next year.

Livestock:

As has been stated it is considered that the main cash income for the African areas in the province should come from this source. Auctions, attended by buyers of Meat Control have been started throughout the reserves and the following numbers of cattle have been sold during the year at these auctions in the various areas:—

West Suk	2,728
Nandi	7,001
Elgeyo	1,714
Baringo	5,217
Samburu	5,474
Total ..	22,134

Sales had to be suspended in some reserves during the year, owing to outbreaks of disease, and although the numbers are not large in relation to the total stock population, which must approach three-quarters of a million in cattle alone, yet it is a start. In addition to the above, some 10,000 sheep and goats were sold and this number would have been considerably higher had it not been for the fact that the Meat Control stopped buying owing to over-supply.

Produce Inspection

This is carried out at certain centres in the European areas and is to deal with forest squatter produce, maize and potatoes. Supplies coming forward during the year have been small and produce inspectors have been withdrawn from several centres.

Marketing

This is catered for, in the case of the European areas, by the various farmers co-operatives, the Kenya Farmers' Association, the Kenya Co-operative Creameries, and the Pig Industry Board and, in the case of the native areas, by the Livestock Control.

Famine Prevention and Relief

Importations of maize meal were required into the reserves of West Suk, Nandi and Baringo during the year; this was in part due to over-selling to other areas, such as Turkana in the case of West Suk, and in part due to a bad harvest in 1947. The meal is purchased at market price by the inhabitants and may cost anything up to Sh. 40 per bag in the more remote areas when transport charges are added. There is no reason why the main areas of the reserves should not be self-supporting in food but in the case of the purely pastoral peoples this demand

for cereal food is comparatively recent and, if supplies are available, is a good thing in that it encourages them to sell stock in order to obtain money to purchase food.

Crop Improvement and Investigation

In addition to the experiments described in the following paragraphs, investigational work has been carried out in collaboration with the Senior Plant Breeder; details of this work will be found in his annual report.

PASTURE

Trials on natural veld:

Red oat grass grazing experiment.—This experiment is being carried out at Rumuruti and full details of the various treatments are contained in the Annual Report of the Senior Agricultural Officer, Rumuruti, for 1945. This experiment has been continued and the results are confirming those given in that report. One outstanding result has been the increase in carrying capacity which has been increased from a beast to 25 acres in 1943 to a beast to 5 acres to date; this may not be a final indication of the carrying capacity of this sward as there have been two good years of rain and de-stocking may be necessary again in a drought year.

Hyparrhenia sward grazing experiment.—This experiment was started this year in the Ndalat area of the Nandi reserve. The lay-out and treatments are similar to those at Rumuruti and no results can be observed to date.

West Suk grazing experiment.—This experiment is in process of being laid down on the same lines as the one at Rumuruti in the semi-arid area of the West Suk reserve.

Investigation on the suppression of Aristida *in favour of* Cynodon-*dominated herbage.*—This experiment was started in 1947 in collaboration with the Senior Agricultural Officer (Pasture Research) on Soysambu Estate.

Management of Cynodon-*dominated pasture and bush encroachment.*—This trial was started at Esageri in 1948, where bush clearing is being done using both cattle and goats for grazing, the object being to determine the following:—

1. The method of management of the sward to prevent the regeneration of bush after clearing.
2. A guide to the carrying capacity of the reclaimed land.

Suppression of Pennisetum schimperii.—This experiment was started in 1944 in collaboration with the Senior Agricultural Officer (Pasture Research) on Mr. Augerard's farm on the Aberdares, its object being to determine methods of management for suppression of *P. schimperi*-dominated sward in favour of *Themeda triandra*. Results to date indicate that the use of fire combined with grazing management can effect this.

Temporary grass leys:

British and indigenous grass yield trials.—These were started at Ol Joro Orok in 1948. Preliminary results indicate that Nzoia Rhodes grass is the best of the indigenous grasses even at this altitude of 7,800 feet and that all the indigenous grasses are more promising than the British species.

British and indigenous grass seeding trials.—These were started at Ol Joro Orok in 1948. Results to date conform with the yield trial and the indigenous species were superior to the British species in their seeding qualities.

Clover variety trials.—Trials of indigenous and exotic varieties of clover are being carried out at Ol Joro Orok and Molo. One which shows considerable promise at the first named place is *T. incarnatum*. An indigenous clover which has shown considerable promise at Kitale is *T. studenerii*. Seed of this is being bulked and it has now been put under trial on a field scale seeded in a ley with Nzoia Rhodes grass.

Pasture ley establishment trials.—Trials have been carried out at Eldoret and Kitale on the methods of establishing leys of Nzoia Rhodes and molasses grass under nurse crops of maize and wheat. In the case of the former nurse crop a satisfactory technique has been evolved over a period of years, but with wheat a further year's trials are necessary to determine the best method of seeding and covering the grass.

Soya Beans

Observation trials of about fifty imported varieties of the above were carried out at Kitale, Eldoret and Nakuru. In general it was found that the most promising varieties were those introduced from Southern Rhodesia and further trials will be carried out with those varieties next year.

Wheat

Variety and yield trials.—These were carried out in collaboration with the Senior Plant Breeder at Ol Joro Orok, Rongai and Molo.

Rate of seeding trials.—These were carried out, in collaboration with the Senior Plant Breeder, at Eldoret, Nakuru and Ol Joro Orok. Seeding rates of 50, 70, 90, 110, 130 and 150 lb. per acre were used and there was no statistical difference between any of the seeding rates at any centre. This may have been due to the exceptionally good wheat year and the trials will be repeated in 1949.

Maize

Observation trials of imported hybrids.—These were carried out at Kitale and Rongai; none of these hybrids from U.S.A. showed any promise.

Fertilizer trial.—The fertilizer trial started at Kitale in 1945, using dressings of Uganda rock phosphate and soda-phosphate at two levels, was continued. In this experiment which runs through a six-year rotation of three years' crop and three years' grass ley, the three years' cropping period has now been completed and the various fertilizer treatments have shown no significant differences. During the grass ley period monthly cuts will be recorded and analysis will be done to determine the effect of the fertilizer on the phosphatic content of the grass.

Sunflowers

A yield trial of the imported dwarf varieties Mars, Pole Star and Jupiter as against the commonly grown one Giant Black, was carried out at Kitale. Giant Black gave a significantly greater yield than the three imported varieties and there was no significant difference between the yields of these three. The trials will be continued at Ol Joro Orok and Kitale in 1949. Seed of the three imported varieties was bulked at Kitale and Ol Joro Orok and is being handed out to selected farmers for further bulking in 1949 before general release.

Pests

Maize stalk borer.—An entomologist was posted to the Kitale Experimental Station towards the end of the year to carry out further investigations in regard to this pest.

Prickly pear.— Work in the use of D.N.O.C. as a control measure for this weed was continued, in collaboration with the Senior Entomologist.

Weedicides

Field trials were carried out at Ol Joro Orok, Eldoret and Nakuru to test the effect of varying applications of Agroxone 1 per cent dust on weeds in cereals. With the exception of the trial at Eldoret there was little effect on weeds from any of the treatments and even in the former case the destruction of weeds had no effect on the subsequent yields of wheat. Small scale trials were also carried out with Agroxone 10 per cent liquid and Chloroxone liquid. The latter gave satisfactory results in the control of spurrey (*Spergluaria arvensis*), *Datura stramonium*, Mexican marigold (*Tagetes minuta*) and blackjack (*Bidens pelosa*) when

applied at concentrations giving two pounds of the active ingredient per acre and upwards, but at this rate of application it cannot be considered economic.

Progress in Improved Farming

Although this section is dealt with under the two headings I would like to stress that the basal problem of fertility maintenance, ley farming and veld management are the same whether under native or European systems of farming, and information obtained on these problems from experimental stations in European areas is equally applicable to the native reserves.

European areas:

The main propaganda in the European areas has been directed, in those areas where climatic conditions and rainfall are suitable, towards the introduction of a system of farming based on alternate husbandry incorporating the use of grass leys, the keeping of stock, and the production of stock products to a much larger extent than is the case at present. It is considered that the present system of cereal monoculture, although highly lucrative at the moment, is bound to lead to the ruination of the land and following that, the farmer. As an indication of the present position acreage returns indicate that only some four per cent of the total arable acreage in the European areas is under temporary grass leys and only three per cent under fodder crops. These proportions are far too small for any balanced system of farming and should, were such a system followed, jointly constitute from two-fifths to one-half of the total cultivated acreage. Some progress has been made in the change-over, but there are several factors which are holding up development of mixed farming. These are:—

1. The high price of cereal crops and the greater cash return per acre obtained from these as compared with stock products.
2. The difficulty in obtaining wire and piping for fencing and water supplies, which are the necessary prerequisites for ley farming.
3. The difficulty in obtaining, and the present high prices of suitable dairy cattle.
4. The shortage of supplies of seed of suitable ley grasses.

The two areas in which least progress is being made towards mixed farming is in the Aberdare-Thomson's Falls area and the Uasin Gishu plateau; in the former area it is due to the high yields and cash returns still being obtained but in the Uasin Gishu, where low yields are obtained, the position is extremely serious as recent analyses of costs and production figures have shown. In this area there seems no hope of at least 25 per cent of the farmers ever accumulating sufficient capital through wheat monoculture to change over to mixed farming, even should they wish to, and unless cheap capital is provided in some form to enable this to be done, there will be increasing demands for increased wheat prices to subsidize decreasing yields and they will eventually become a burden on the state.

Native areas:

Pastoral areas.—These vary from low rainfall areas, such as Leroghi and Southern Kamasia, to semi-arid and desert areas, such as Lower Samburu and East Suk. In all of them the problems are similar and are concerned with stock reduction and grazing control in which latter the provision of more adequate water supplies must play a large part. Stock reduction has been encouraged by the starting of stock sales in all reserves throughout the province which are attended by buyers of the Meat Marketing Board, but it is only on the Leroghi plateau that the stock are limited to the carrying capacity of the land and their number controlled under rules under the Crop Production and Livestock Ordinance. Areas of grazing have been closed in West Suk for some years during the growing period, being opened for grazing during the dry season, and recovery has generally been fair. In the Nandi reserve the practice of closing areas of grazing during the rains for dry season grazing reserve, is catching on rapidly, the areas being demarcated and controlled by the local inhabitants and whilst this will not solve the overstocking problem, it is a step forward in grazing control and management.

Semi-pastoral and agricultural areas.—These comprise the higher areas of West Suk, Elgeyo, Kabarnet and the whole of Nandi. All these areas have a good assured rainfall and are eminently suited for the development of intensive farming on a ley-arable system. In most of them the population densities are not yet such that pressure on the land prevents the abandonment of the old practice of shifting cultivation; the same remarks, however, regarding pressure of human population on the land do not apply to stock and most of the areas are over-stocked with cattle, sheep and goats and before any real progress towards mixed farming can be made this problem must be tackled. It is considered that the main work must be to try and introduce the grass ley in place of the bush fallow, to provide more grazing for stock and to stress the idea of alternate husbandry. In the reserves of Kamasia, West Suk and Elgeyo, cultivation is fortunately controlled by Local Native Council by-laws and new shambas may not be opened up without the permission of the District Commissioner or his deputy: under this law efforts are being made to restrict cultivation to suitable sites and to limit overcropping. In the higher areas the grass ley presents no problem as, providing the land is not over-cropped it reverts naturally to a Kikuyu grass sward. In other areas seed of the grasses Nzoia Rhodes, molasses, and *Bromus marginatus* are being bulked in the demonstration plots for issue, the plots being run on a ley-arable rotation. Some paddock fencing is taking place in the Nandi and Elgeyo reserves and this would extend rapidly were fencing wire in free supply. With a view to controlling wholesale enclosure of land by a few individuals the Nandi Local Native Council have proposed a by-law giving them powers to control and limit fencing by private individuals. One feels at present that these fenced areas are just being used as a means of procuring more land either for arable cropping or as a private reserve grazing area for the dry season, the stock taking their share of the communal grazing during the rains. There is, as yet, no evidence of any attempt at proper land utilization on a ley-arable system of farming on these enclosed areas.

Soil Conservation

This has been dealt with in its more general terms in the preceding paragraph and it will suffice, therefore, to refer, under this heading, only to the mechanical aids and the provision of water supplies by dam making.

European areas:

The terracing units of the Soil Conservation Service have been kept fully occupied during the period and demand continues to exceed capacity. It is becoming more and more apparent that mechanical means of controlling soil erosion must be combined with a balanced system of cropping to be fully effective, and that farms and in many cases topographical areas must be planned and worked in as one unit if lasting results are to be achieved. The Rongai Valley scheme is an excellent example of this and endeavours are being made to plan whole farms on conservation lines in other areas rather than to do haphazard terracing. There is no doubt that farmers are becoming more concerned about the state of their soil and erosion conscious but there is a feeling amongst officers that the demands from farmers for terracing, which are many, are made on the assumption that once the land is terraced it can take no hurt and that it can then suffer continued punishment under a system of cereal monoculture. If much of the land had been farmed on a conservative system of ley farming five years ago the necessity and demand for terracing it today would never have arisen.

The Soil Conservation Service dam construction unit has done excellent work in the Uasin Gishu and Thomson's Falls area and with its departure to Machakos it will leave a large programme, for which the demand is increasing daily, uncompleted. It is hoped that more of these units may be available in future to carry on with this work, which is essential if a change-over from crops to stock is to be made.

Numerous orders prohibiting cultivation on steep slopes and in stream beds have been served under the Land and Water Preservation Ordinance and several

closure orders, prohibiting further cultivation, have been served on parts of farms. This latter method, although in itself a negative step, may have the effect of putting the farmer out of business or making him change over to a balanced system of farming; it is considered that if the former unfortunately occurred the farmer would have gone out of business in any case if he continued to crop worn out land, and an order in time prevents him ruining the land in the process.

Native areas:

Narrow base terracing is being set out by Agricultural Instructors with line levels and this work is proceeding satisfactorily. In West Suk and in Kabarnet it is the exception rather than the rule to find shambas without terraces, and although their construction often leaves something to be desired, yet it is the beginning of a custom. An endeavour is being made to get all terrace banks planted up with grass in order that they may remain demarcated during the fallow period, thus avoiding having to re-do the work when the land again comes under crop.

Dam construction is being carried out under the supervision of Assistant Agricultural Officers in West Suk, Southern Kamasia and in Samburu.

One of the major problems is the soil destruction which has occurred in Southern Kamasia and in connexion with this the Esageri and Solai border schemes, financed by the African Land Utilization and Settlement Board, are designed, when water supplies have been put in and bush clearing done, to provide areas to which population and stock can be moved whilst areas of the reserve are reconditioned.

Agricultural Education

European areas:

In the European areas this is provided by the Egerton School of Agriculture, which has been running short courses for intending settlers. Part of these courses has been spent in visiting representative farms in the Uasin Gishu and Trans Nzoia, on which visits students have been conducted by the Agricultural Officer in charge of the area concerned.

The Young Farmers Club, started in the Njoro-Nakuru area, continues to function actively and is doing good work in stimulating interest and discussion on better farming methods.

Native areas:

Most of the Government African schools in the native areas in the province have agricultural bias, the success of the one at Kapenguria being well known. The proposed new school at this centre will fill a great need and, it is hoped, provide a suitable training ground for departmental African staff for the province.

Communications

The European areas are well served by road and rail communications, indeed, in some areas the number of roads seem to be more than can be properly attended to by the local authorities.

In the African areas, the Kapenguria-Marich road, recently completed, has proved a valuable link between Kapenguria and the lower areas of West Suk and has turned what used to be a three days' foot safari to the boundary of this district and the lower areas of Marakwet into a six hours' journey by lorry. Other roads in the native areas in process of construction are Kapenguria-Lelan, Irong-Metkei, and Kabarnet-Ravine, of which the latter will be most valuable in bringing Kabarnet within easy reach of Nakuru, the present way being through Eldoret, Tambach, and across the Kerio Valley.

Pests, Diseases

Insect:

Stalk borer.—The incidence of this pest is very much less than in 1947. This is in part due to the control measures instituted and in part due to the long dry season which eliminated any volunteer growth of maize. The regulation concerning enforced burning of crop residues of maize was not brought in after the 1948 harvest for this reason.

Cut worm.—This pest was very active after the dry spell following the breaking of the rains and following the germination of the maize crop; replanting was necessary in some instances and, where it proved too late for maize, wheat and sunflower were planted as alternatives.

Chafer grub.—The incidence of this pest has receded over recent years, but it may be presumed that further outbreaks will occur.

Locusts.—There have been no locusts in any area during the year.

Plant:

Datura stramonium.—This noxious weed is still on the increase in all districts in spite of efforts to control it and it is doubtful, on account of the way in which the seed retains viability in the soil, if it can ever be completely brought under control. Farmers are taking more care, however, to eliminate this weed from their cereal crops as the following figures for deliveries of wheat to Unga, Ltd., will show:—

Fines for *Datura stramonium:*

1946	*1947*	*1948*
£704	£1,092	£78

Consignments of grain containing *Datura stramonium:*

1946	*1947*	*1948*
69	40	13

Darnel—Lolium temulentum.—The above noxious weed is on the increase in all areas and there is no doubt that its spread is in part being caused by the use of infected seed. This has been brought out clearly during the field inspection and seed testing service carried out during the past year when, in some areas, as many as 50 per cent of the crops inspected were rejected, either in the field, or on testing in the laboratory on account of the presence of darnel. To give some indication of the increase and extent of the infestation the following figures have been supplied by Unga, Ltd., Eldoret, on wheat supplied to their mills:—

1945.—11,449 bags of wheat were degraded for containing ½ per cent or over of darnel seed.

1946.—24,305 bags of wheat were degraded for containing ½ per cent or over of darnel seed.

1947.—37,545 bags of wheat were degraded for containing ½ per cent or over of darnel seed.

1948.—31,984 bags of wheat were degraded for containing ½ per cent or over of darnel seed.

The only effective method of keeping this weed in check is through maintaining, or increasing, the present system of fines so that it pays a farmer to use clean seed and rotate his crops.

Fungus:

Stem rust.—The above has been more prevalent this year, especially on non-resistant varieties of wheat in the Uasin Gishu area.

General

The centralization of the control of agricultural work in the province, both of the European and Native areas, under the Nakuru office, has meant a certain amount of reorganization and a large amount of time has had to be spent on safari and in getting to know the areas concerned.

In conclusion I would wish to express my thanks to the many farmers who have helped us with co-operative experiments, to the chairmen of Production Committees for their help and advice, to the Administration for their co-operation and help in agricultural matters and, finally but not least, to the departmental officers for their keenness and energy in carrying out their work.

R. E. T. HOBBS,
Senior Agricultural Officer, Rift Valley Province.

ANNUAL REPORT OF THE SENIOR AGRICULTURAL OFFICER, CENTRAL PROVINCE, 1948

Staff

European

The following shows the staff position at the end of the year:—

Province.—Mr. J. T. Moon, i/c, Senior Agricultural Officer, Mr. W. J. A. Hubbard, European Clerk.

Meru.—Mr. J. P. Benson, i/c, Senior Assistant Agricultural Officer, Mr. T. R. Golding, Assistant Agricultural Officer, Mr. A. F. H. Scott, Marketing Officer.

Embu.—Mr. L. H. Brown, i/c, Agricultural Officer, Mr. J. K. Ammonds, Assistant Agricultural Officer, Mr. W. F. Rendall, Assistant Agricultural Officer.

South Nyeri.—Mr. T. Hughes Rice, i/c, Senior Assistant Agricultural Officer, Mr. S. M. Jordan, Assistant Agricultural Officer, Mr. F. S. Dalgleish, Assistant Agricultural Officer, Mr. G. O. Hughes, Marketing Officer.

Fort Hall.—Mr. C. D. Knight, i/c, Senior Assistant Agricultural Officer, Mr. G. C. H. Hill, Assistant Agricultural Officer, Mr. P. C. Cary, Marketing Officer.

Kiambu.—Mr. G. J. Gollop, i/c, Senior Assistant Agricultural Officer, Mr. I. G. Brown, Assistant Agricultural Officer, Mr. G. N. Milne, Marketing Officer.

Machakos.—Mr. G. S. Cowley, D.F.C., i/c, Agricultural Officer, Mr. E. S. Porter, Agricultural Officer, Mr. J. S. Bagenal, Assistant Agricultural Officer.

Kitui.—Mr. L. C. Edwards, i/c, Senior Assistant Agricultural Officer.

Transfers, Leave and New Appointments.—Mr. Gollop proceeded on vacation leave in February and returned to Kiambu in October. His place was filled temporarily by Mr. Bellis. Mr. Goodwin handed over South Nyeri District to Mr. Hughes Rice in January. Mr. Porter, Agricultural Officer, was posted to Machakos in October on first appointment. Messrs. Ammonds, Rendall and Dalgleish were posted to the province as Assistant Agricultural Officers during the year. Messrs. Scott, Hughes and Cary filled the three vacancies as Marketing Officers.

African

Government—	
Makerere Assistants	2
Clerks	11
Agricultural Instructors	164
Produce Inspectors	3
Apprentices	6
Labourers	64
Soil conservation staff	1
Sundry employees	11
	262
L.N.C.—	
Agricultural Instructors	3
Assistant Agricultural Instructors	340
Produce Inspectors	60
Vermin Poisoners	25
Grazing, furrow guards, etc.	43
Tree nursery staff	49
Markets staff	61
Labourers	335
Sundry employees	1
	917

D.A.R.A.—	
Clerks	1
Agricultural Instructors	41
Assistant Agricultural Instructors	380
River Scouts	17
Levellers	4
Grazing Guards	3
Labour—Soil conservation	292
Sundry employees	17
	755
Grand total:	1,934

Travelling

European officers spent altogether 928 nights on safari and travelled 67,719 miles by car.

Seasonal Conditions

The 1947 short rains were good in Meru but rather indifferent elsewhere and in all districts the finishing rains of January and February, which are so useful for the successful maturing of cereal crops, failed to materialize. Nevertheless, short rains crops, although very poor in places, were harvested and the food position early in the year gave no cause for anxiety. There is little doubt that the residual effect of the excellent 1947 long rains, reflected in the moisture content of the subsoil, was instrumental in seeing the short rains crops through.

The 1948 long rains broke early in some areas and, in fact, where cultivators were ready, some planting was successfully carried out before the end of February. Although there was a dry spell in March rainfall for that month was about average and that for April was well up to normal. In Meru, parts of Embu, Machakos and Kitui the rains ceased abruptly early in May to be followed by five full months of drought. Yields of crops in these areas were therefore materially reduced. In the other districts rainfall was rather below average generally but good distribution was responsible for very satisfactory crops being reaped.

The mist season was less intense than usual and was late in arriving which, in Embu, resulted in a smaller acreage of crops than usual being planted. In South Nyeri *Gathano* crops benefited from the mild mist season.

The short rains broke suddenly in the middle of October in Meru, Embu and the northern portion of the Kikuyu districts and were particularly intense in Meru which station recorded 8.67 inches in one night, the highest daily total ever measured. Except in Meru, the break of the rains was followed by a fortnight of dry weather, the short rains becoming general in November. November and December were decidedly wet months, particularly in the lower areas, the vicinity of Nairobi and Machakos. Half of South Nyeri District unfortunately missed the excellent rains which fell elsewhere Short rains crops varied from very good in the case of millets in the lower areas to failures in parts of South Nyeri.

1948, to summarize, was not such a good year as 1947 but as far as crop growth is concerned was well above the average of the few years prior to 1946. Details of rainfall will be found in Appendix I.

Crop Production

Bananas.—This crop continued to yield well in the higher areas and its value as a food crop is often under-estimated. In addition to the very considerable internal movements of bananas within districts, vast quantities leave South Nyeri, Fort Hall and Kiambu for consumption in Nairobi. With a sound food position in the banana-growing areas no ban on their export has been necessary. The need for better organized marketing arrangements for this crop is increasingly apparent. However, bananas have one great advantage over other famine prevention crops in that in times of plenty the surplus can be marketed with little trouble and no

preparation of the product. The estimated value of sales of bananas exported to Nairobi and elsewhere during 1948 is £48,058, which is probably well below the true figure.

Beans.—There is little doubt that the acreage of beans is less than it used to be as less are grown for sale. This state of affairs has been brought about by the high price of maize and, from the rotational value which beans offer, is to be deplored.

The 1947 short rains harvest was rather indifferent and the following long rains crop none too good. Meru, Embu and South Nyeri are the main exporting districts. Total exports amount to 4,274 bags.

Cassava.—The root food reserves of cassava in the ground in Meru District show a most satisfactory state of affairs but some fears are felt that, with the excellent food position in that district insufficient care will be taken to maintain the acreage. With this in view the drying of cassava, either for storage or sale, is being taught. A campaign to plant a bigger acreage in Embu District met with some success. The results of intensive campaigns of the past in Machakos and Kitui, are now very apparent and most parts of these districts now possess some cassava, if not sufficient yet to carry the people through a prolonged food shortage.

Coffee (*Arabica*).—The following table shows the present position in Meru and Embu Districts:—

District	Area	Total Acres	Total Growers	Sales
				Sh.
Embu ..	Githungururu ..	22·5	86	19,797·04
	Ngandori	16·5	71	
	Kyeni	5·5	28	
	Kagaari	5·5	27	
Meru ..	Chogoria	192·62	607	62,628·73
	Meru	56·07	165	
	Chuka	35·69	169	
	Tigania	0·55	4	
	Muthambi	4·66	50	
	Nkwene	2·00	12	
	Katheri	0·60	3	
	Totals ..	342·19	1,222	82,425·77

The above figures represent an increase of 100.73 acres and 355 growers over the 1947 figures. The total value of sales during 1948 was £4,121.

For many years, partly due to restrictions on acreage and partly due to apathy on the part of the growers, the extension of coffee-growing was very slow. In so far as Meru District is concerned we now appear to be on the eve of great developments and we are fortunate enough to have achieved the complete confidence of the African farmers. To illustrate the position the Senior Assistant Agricultural Officer's, Meru, report is quoted:—

"My contention that the development of the coffee industry would eventually lead to improved systems of agriculture in those areas where it was started is I believe now being justified. The rapid progress towards a better system of agriculture which is being developed in Chogoria for instance, can be attributed largely to the fact that growers, having followed our advice on coffee with remarkable success have become so confident that they will now follow it in other directions.

"It became obvious that only by heavy manuring and mulching could the quality and yields of coffee be improved. Our insistence on this over a period of years has shown remarkable results, and what is more, the majority of growers

have realized the fact. There are many examples to be found where, having seen what the application of manure can do for coffee, the people are turning their attention to the manuring of other crops.

"Others, who have found it impossible to purchase manure owing to the ever-increasing demand, are gradually making provision for stock of their own. The cleaning of bush, the planting of grass paddocks, and the building of cattle bomas and compost pits which one sees going on everywhere is ample evidence of this.

"More than this, it has become so evident to all concerned that the amount of coffee a grower can maintain depends upon his available manure, that we have been able to discriminate when permitting a grower to increase the size of his plantation. It has become the rule that before an increase is allowed we must be satisfied that the existing area is properly maintained; if it is not he is compelled to provide himself with a cattle boma close to the homestead before he may increase the size of his plantation.

"I know of one grower with 200 trees who has purchased himself a herd of five head of cattle entirely from the proceeds of his coffee. He now has ample manure and a supply of milk for his family."

Five nurseries now supply the needs of the Meru growers from which seedlings for an even greater extension will be available next year. The average number of trees per grower in Meru is now 155 or 0.28 of an acre. Experience has shown that optimum yields are obtained when a grower has reached 300 trees, after this his yield per tree falls off. The acreage could therefore be doubled in existing areas with no further new growers.

A new water-powered factory on the Mara River which serves the northern end of the Chogoria area proved of great value and handled a large crop economically and quickly. The original factory at Mutindwa is being similarly converted and the laborious work of hand-pulping will cease.

The following table gives the classification of Meru deliveries during the year:—

	Chogoria 1947/48		Chogoria 1948/49	
	September–November harvest		March–April harvest	
	lb.	%	lb.	%
Class 2	—	—	3,725	45·67
3	6,330	26·64	273	3·34
4	9,792	41·21	2,294	28·12
5	4,111	17·30	242	2·96
6	2,357	9·92	1,280	15·70
7	1,082	4·56	191	2·34
8	18	0·08	153	1·87
9	56	0·23	—	—
10	14	0·06	—	—
Total	23,760	—	8,157	—

The figure of 67.85 per cent and 77.13 per cent classification in the top four grades is a good indication of the quality of the coffee and shows how, by careful arrangement of picking, lack of uniformity in quality due to the varying climatic and soil conditions and age of trees, can be overcome.

The care and cultivation of the plots, both in Meru and Embu, improved during the year and most of the growers now appreciate that the various operations which we advocate do increase yields and therefore the cash return. One outstanding coffee plot, and there are others not far behind it, gave a cash return of Sh. 5/20 per tree from the October/December harvest and a further crop will be

picked in May, 1949. A safe estimate would be an annual cash return of Sh. 7/50 per tree or over £200 per acre. A well-known European coffee farmer who visited this particular plot at Chogoria expressed the opinion he had never seen better coffee anywhere in East Africa.

The Co-operative Societies at Meru, Chogoria and Embu functioned smoothly but facilities for loans for capital development are needed. Further societies to serve the new areas in Meru District will be necessary shortly.

The extension of coffee-growing to the Kikuyu districts is under consideration and it is hoped that definite progress in selected areas will be made soon.

Colocasia.—This crop is apparently grown to a lesser extent than formerly. Before the soils of the higher areas became impoverished *Colocasia* was grown extensively in the open fields. Now its cultivation is confined to swampy places.

Cowpeas.—This crop is essentially the legume of the low, arid areas and although only small amounts are sold, considerable quantities are consumed internally. The 1947 short rains crop was satisfactory but the long rains harvest only light. November plantings show promise.

Dolichos.—In spite of rather unsuitable weather in the main producing area—Meru—a fair crop was harvested in August and large quantities were exported from that district. Representations to decontrol this crop were successful and the price trend was exactly as anticipated. If control had continued at the very low price gazetted the province would have faced the danger of a reduction in the acreage of this excellent leguminous crop and a further increase in the maize acreage.

Grams.—Bengal gram is becoming increasingly popular and this crop provides an excellent cash return in the areas in which it is grown. Yields were generally satisfactory.

Green gram grown in the 1947 short rains yielded well but the long rains crop was poor. Some black gram is grown, largely in Meru district.

Maize.—Yields of maize from the 1947 short rains crop were good in Meru but light elsewhere. As a considerable carry-over from the 1947 long rains was held by growers, steady sales to the Control took place. Long rains crops in the Kikuyu districts and Embu were well above average as the distribution, rather than the quantity of rainfall, suited this crop. In the lower areas and Machakos the crop yielded only lightly.

The *Gathano* crop in South Nyeri was well above average but rather poor in Fort Hall and Kiambu.

Short rains maize made excellent growth throughout November and December, except in South Nyeri where it was droughted, but with no rain early in 1949 yields will be reduced very considerably.

The outstanding feature noticeable with this crop in Central Province is declining yields. Only when climatic conditions are perfect are satisfactory crops reaped unless adequate organic manure is used. The phenomenal increases in yield when either imported Masai manure or locally produced farmyard manure or compost are used provide remarkable ocular demonstrations. To aggravate the position the price inducement held out to European growers reflects on the price of native maize which is far too high in relation to that of other crops. By such a policy we pander to the popularity of maize in the African's diet, which fact is indisputably unfortunate, and the chance of weaning the African from the crop becomes ever more remote.

The very great disparity between the price of maize and the Control selling price of maize meal has the effect of raising the internal posho price to an absurd level, thus making the growing of the more suitable millets and sorghum less popular than ever.

A total of 203,346 bags of maize were exported from the province with a value to the producers of £132,446.

Millets.—(1) *Bulrush.* The yield of 1947 planted crops was excellent in Meru but only fair elsewhere. The 1948 crop came away to an excellent start in November/December and generally speaking harvest prospects are excellent. Good short rains are a mixed blessing as maize crops planted in unsuitable low areas produce some sort of yield and lead growers to gamble on a repetition in following years. If more reliance were placed on bulrush millet each year crop failures would be far less common.

(2) *Foxtail.*—Yields in South Nyeri were reasonably good but the light mists restricted the acreage grown in Embu and Fort Hall.

(3) *Finger.*—Only very small quantities are grown.

30,610 bags of millet, valued at £27,698, were sold.

Onions.—This crop is of increasing importance to Kiambu, in which district many of the larger users of imported manure expect to meet the cost of the latter from the sale of onions. A good harvest was lifted in January and February but the long rains crop was affected by the cold weather which followed. The 1948 short rains crop is indifferent.

Unfortunately there has been a decline in onion-growing in the Mathira division of South Nyeri where production of green vegetables has tended to replace onions.

The value of exports was £3,294.

Peas (field).—The main exporting area is Kiambu though the crop is grown to a lesser extent throughout all the higher areas. The long rains harvest was fair although mildew attacked the crop.

Pigeon peas.—The young crop looked well early in the year but the abrupt cessation of the rains in Meru and Kitui early in May caused a reduction in yield. Generally, however, the crop was satisfactory and freer from "wilt" than in previous years. The new crop planted in November/December made an excellent start.

Potatoes (English).—A big surplus was sold in Meru early in the year and the yield from the Kiambu and Nyeri long rains crops was fair to good, though the incidence of "blight" was the limiting factor.

Short rains crops showed early promise but "blight" subsequently appeared and yields may prove much lighter than was hoped. Resistant varieties are in great demand, notably the type 914, which unfortunately is likely to prove an indifferent saleable potato though possibly suitable for African consumption.

Control was removed early in the year and prices jumped to a fantastic height for a short while. Subsequently prices found their true level and these still make the growing of potatoes remunerative.

68,658 bags valued at £67,326 were sold.

Potatoes (sweet).—Sweet potatoes continue to be a popular crop in all areas, though to a lesser extent in the lower, dry areas. Supplies have been sufficient for internal needs during the season and the "tops" have proved as valuable as ever for stock feed.

Pyrethrum.—Apart from two growers in Fort Hall this crop is confined to Kiambu District. Flushing was poor during the first part of the year but the November rains brought the crop on well. Some of the older fields now need replanting.

Figures (for nine months only) were: —

Grade I	8,532 lb.	
Grade II	10,097 lb.	
Grade III	15,663 lb.	
Total: ..	34,292 lb.	valued at £1,285.

Sorghum.—It is only in the lowest areas that this crop is really important though it could be grown with advantage to a much greater extent in the intermediate areas replacing a proportion of maize. Crops were healthy and yielded well.

Sugar cane.—A useful food crop but more frequently used for the preparation of liquor, and always grown where moisture conditions are suitable. There is a considerable acreage in the Chuka area of Meru District and growers have requested that the matter of a processing plant be considered. The main objection would appear to be the safeguards necessary to prevent the finished product, presumably jaggery from reaching Ukambani.

Tea.—Consideration has been given to the possibility of extending tea growing in the higher parts of the Kikuyu country to a factory scale. At present there is a very small local industry in Fort Hall District only.

Tobacco (flue-cured).

District	Short rains green leaf			Long rains green leaf		
	Acres	Pounds	Paid to growers	Acres	Pounds	Paid to growers
			Sh.			*Sh.*
Embu	70	238,475	11,802·28	40	111,668	5,416·93
Fort Hall ..	55	188,654	9,336·59	57	204,950	9,941·60
Kitui	102	503,895	24,294·83	120	434,911	20,254·28
Total ..	227	931,024	45,433·70	217	751,529	35,612·81

The first crop in Kitui (1947 S.R.) was an excellent one and gave the second highest yield per acre recorded for that district. That for Sagana was also above average for that area.

The long rains crop at Kitui was planted under very difficult conditions and overgrown nursery transplants necessitated the importation of plants from Sagana. These appeared in good condition on arrival but they failed to make good growth probably through lack of sufficient rain subsequently. The leaf was small and light but little "white mould" was evident. The Sagana crop was satisfactory in so far as Embu was concerned but the Fort Hall side experienced insufficient rain.

The 1948 Kitui short rains crop was looking excellent at the end of the year and the Embu crop promising. The Fort Hall crop is reported as not so satisfactory.

The total value of the 1948 crops was £4,052 which was £1,113 greater than in 1947.

Efforts to interest the purchasing company in further potential tobacco-growing areas have to date been unsuccessful.

Tobacco (Native-cured).—The more important districts in this respect are Meru and South Nyeri where thriving native industries exist. The price in Meru was around 60 cents per pound. Weather conditions suited the crop and revenue is estimated at £18,199.

Vegetables, Fruit and Flowers.— These continue to leave Kiambu in very large quantities but the marketing of them is still unorganized and unsatisfactory and needs urgent attention. The same remarks apply to the rest of the province and

our immediate concern is not so much a marketing department to replace the existing controls but some organization to direct supply of fresh produce. Given that direction the province could go ahead and produce good quality fruit, etc., which is so sorely needed.

With regard to vegetables at Karatina, this area has the great advantage of irrigation and land laid out for the use of water. On the marketing side very considerable difficulties were experienced as the receiving organization, having urged growers to produce more, subsequently reduced the weekly orders to a negligible amount.

Wattle.—Wattle prices again rose during the year and it is surprising that the two seasons ran as smoothly as they did. Trouble, however, was experienced at Karatina and to a lesser degree at Ruiru.

It is very pleasing to report that the whole question of increasing quotas to get rid of the accumulation of mature bark has been favourably received by the companies, and that the urgent need for increased storage facilities is to have attention. The days when the companies can rely on immediate railing of bark after purchase are probably over for ever.

The revenue from the sale of bark quite apart from the valuable by-products in the form of fuel, building poles and charcoal, is the highest single item for the province and during 1948 represented £258,787.

Wheat.—Wheat sales in Meru declined but the acreage is little different from previous years. Internal consumption is increasing and this is encouraging.

Attempts to popularize wheat in the higher Kikuyu country, where maize is unsatisfactory, have met with only limited success.

Yams.—These provide a useful standby but mealy bug still persists in parts.

PLANTING AND HARVESTING TIME FOR ECONOMIC CROPS

CROP		PLANTED	HARVESTED
Maize	L.R.	March-April	August-October
	Mist Zone	July-August	February-March
	S.R.	October-November	February-March
Beans	L.R.	March-April	June-July
	S.R.	October-November	January-February
Grams	L.R.	March-April	June-July
	S.R.	October-November	January-February
Dolichos		March-April	August-September
Pigeon peas		October-November	August-September
Mtama	L.R.	March-April	January-February
	S.R.	October-November	July-August
Bulrush millet		October-November	February-March
Foxtail millet		August	January
Wheat		October-November	January-February
Potatoes	L.R.	March-April	June-July
	S.R.	October-November	February-March
Tobacco	L.R.	March-April	June-August
	S.R.	October-November	January-March
Coffee		March-April	October-December

Livestock Produce

Hides.—There was a slight increase in the quantity of hides marketed. Quality is still indifferent and a large potential source of revenue is lost. Total value of hides sold £32,529.

Skins.—The quantity of skins marketed decreased by approximately 10,000 score. The remarks *re* quality under "Hides" apply equally. Total value of skins sold £57,096.

Pigs.—Although the number of pigs sold to the Nyeri Pig Finishing Station showed a slight reduction, revenue was about the same as in 1947—£556. The keeping of larders for home consumption and sale of lard is still popular.

Poultry.—The number of poultry sold showed a rise from the 1947 figure of 317,508 head to 357,487 head in 1948 valued at £50,623. This tendency is a good sign as it is far better that surplus cereals should be converted into protein before sale. In this way fertility is not removed from the reserves.

Eggs.—The number of eggs shown as exported declined by 3,000,000. This probably does not represent the true state of affairs and no doubt many eggs are never recorded.

Produce Inspection

Activities are still largely concerned with the inspection of wattle bark. In spite of high prices, which tend to result in poor undergrade bark being offered, a general improvement in the quality sold took place. It is certain, however, were we to relax our efforts, quality would rapidly deteriorate again.

With a view to making the fairest allocations of wattle quotas possible to the various locations or parts of locations, a start has been made on the compilation of wattle registers. The task is not an easy one and rather naturally surveys undertaken by African staff must be checked in part, if not in whole, by a European officer. The registers are designed to show the quantity of bark which is already mature, that quantity approaching maturity and immature bark. The indication is that we are fully justified in asking for the quota to be increased to 47,000 tons per annum for the province for several years to come.

The inspection of other produce ran reasonably smoothly and the quantities handled were considerable in contrast to the disastrous drought years prior to 1946.

Marketing

The staff of Marketing Officers was brought up to the full existing establishment by appointments to Nyeri, Meru and Fort Hall respectively, and a start has been made on the very necessary reorganization of marketing. It is not out of place to mention that the full benefit of the appointments will not be felt until a receiving organization for fresh produce is instituted. A big demand for this produce is believed to exist, the produce certainly does but the connexion between the two is tenuous. The Senior Assistant Agricultural Officer, South Nyeri, writes:—

> "There appears to be some hope that the Marketing Organization may be given birth before long. It is quite certain that, properly handled, this will give a great stimulus to production, and it is eagerly awaited. At present marketing is, apart from controlled produce, quite haphazard, inefficient and grossly wasteful of time and money, with the usual result that the producer gets little for his labours, and the consumer pays too much for too little."

In Fort Hall the system followed was most unsatisfactory. Disposal instructions were issued to traders on demand, but the trader, armed with this certificate of immunity, made every effort to sell his maize or other produce in the most lucrative market, e.g. Ukambani, and not to the Control. As a result disposal instructions might be outstanding for months and much produce was lost to the district on which no Betterment Fund was collected. Since the end of the year this matter has been rectified.

Mention should be made of the progress of co-operative societies. Apart from the earlier coffee societies a number of others have been registered or are about to be registered. Amongst these are the Nyeri Pig Producers, the Tuso Plum Growers, the Karatina Vegetable Growers and the Kiambu Pineapple Growers. The idea of co-operative marketing is spreading and once these societies have the receiving organization which is so vitally necessary greater progress may be expected.

Prices paid to producers for the commodities shown are given below:—

	Unit	F.O.R. at 31–12–48	Average price to producer during year
	lb.	*Sh.*	*Sh.*
Maize	200	12 95	12 00
Boston beans	„	23 00	21 00
Rose Coco beans	„	18 00	16 00
Canadian Wonder beans	„	17 00	15 00
Mixed beans	„	14 00	12 00
Bengal gram	„	50 00	48 00
Green gram	„	42 00	40 00
Black gram	„	50 00	48 00
Pigeon pea	„	40 00	37 00
Cow peas	„	20 00	25 00
Dolichos bean	„	40 00	37 00
Wheat	„	29 00	24 00
Potatoes	„	15 00	18 00*
Field peas	„	23 00	21 00
Mtama	„	10 25	10 00
Bulrush millet	„	18 00	16 00
Foxtail millet	„	18 00	16 00
Ghee	36	—	58 00
Beeswax	„	—	90 00
Wattle bark (Jan–March)	ton	184 00	193 00
Wattle bark (Aug.–Oct.)	„	227 00	
Hides (shade dried)	36	—	35 00
Skins	Score	—	50 00

*This price is well above railhead price as a very large proportion of the crop is sold from Kiambu district direct to consumers in Nairobi.

STATEMENT OF REVENUE FROM PRODUCE

Produce	Sales 1947		Sales 1948	
		£		£
Maize	180,936 bags	99,514	203,346 bags	132,446
Millets	18,977 bags	14,232	30,610 bags	27,698
Sorghum	3,569 bags	2,169	4,477 bags	2,605
Wheat	1,173 bags	1,216	298 bags	358
Legumes	104,557 bags	195,041	76,149 bags	132,256
Potatoes	52,188 bags	33,608	68,658 bags	67,326
Pyrethrum	—	3,000	34,292 lb.	1,285
Tobacco (flue cured green)	1,185,341 lb.	2,939	1,647,989 lb.	4,052
Tobacco (native cured)	347,346 lb.	6,465	293,610 lb.	18,199
Coffee parchment	30,095 lb.	1,765	60,415 lb.	2,722
Coffee mbuni	52,543 lb.	840	86,487 lb.	1,399
Vegetables, fruit and flowers	—	114,637	—	103,245
Bananas	6,227 tons	25,723	—	48,058
Onions	16,583 fra.	5,970	8,920 fra.	3,294
Beeswax	979 fra.	4,308	2,767 fra.	11,861
Wattle bark	25,915 tons	187,158	26,734 tons	258,787
Fuel and poles	78,475 tons	24,000	—	54,500
Charcoal	305,472 bags	23,523	—	15,709
Hides	16,075 fra.	32,150	18,789 fra.	32,529
Skins	32,389 sco.	80,472	22,352 sco.	57,096
Ghee	1,966 tins	1,308	148 fra.	431
Pigs	245 hd.	588	214 hd.	556
Poultry	317,508 hd.	39,941	357,487 hd.	50,623
Eggs	8,614,920 eggs	36,864	5,616,529 eggs	25,300
Miraa (*Catha edulis*)	—	92,793	—	21,600
Miscellaneous	—	9,290	—	22,635
		1,039,514		1,096,570

Famine Prevention and Relief

There was no need for famine relief during the year though Kitui and Machakos Districts might have been in difficulties had the short rains not proved adequate. Local shortages, where they occurred, were made up by internal movements. The general food position is reflected in the considerable sales of produce shown in the preceding table.

In the Kikuyu Districts more reliance is placed on bananas, sugar cane, yams and *colocasia* as famine prevention crops. In the other districts the acreage of cassava increases gradually and if this rate can be accelerated the chances of severe food shortage will be minimized.

Crop Improvement and Investigation

With the Provincial Experiment Station still not in being only a very limited amount of investigational work was possible.

Hybrid Maize.—The result of the trial carried out at Embu in the long rains is given in the accompanying table.

HYBRID MAIZE TRIAL

	Muratha	W. 19	W. 59	Yellow No. 18	Yellow No. 12	White	S.R. Hybrid N. 311 x M. 99
Date of planting ..	10–3–48	10–3–48	10–3–48	10–3–48	10–3–48	10–3–48	10–3–48
Date of germinating	17–3–48	16–3–48	18–3–48	18–3–48	17–3–48	18–3–48	16–3–48
Date of tasseling ..	13–5–48	29–4–48	4–5–48	17–5–48	24–5–48	14–5–48	14–5–48
Date of cobs appearing	17–5–48	1–5–48	6–5–48	19–5–48	15–5–48	16–5–48	19–5–48
Date of harvest ..	30–8–48	2–7–48	16–7–48	11–8–48	11–8–48	11–8–48	30–8–48
Spacing	3′x1′	3′x1′	3′x1′	3′x1′	3′x1′	3′x1′	3′x1′
No. of seeds planted	88	88	88	88	88	88	88
No. of seeds germinated	56	51	34	17	19	18	30
No. of plants at harvest	37	27	29	11	17	10	18
No. of cobs	49	33	27	20	32	18	28
No. of cobs under 4–5 inches	10	6	8	2	6	7	2
Weight of cobs and nubbins ..	32lb. 7 oz.	12½lb.	13lb.	12lb.	17lb.	17lb. 9oz.	17lb. 14oz.
Shelled grain ..	26lb.	10lb.	10lb. 10oz.	9lb. 12oz.	13lb. 11oz.	6lb. 2oz.	15lb. 8oz.
Average height of plants	10½′	7′ 0″	7′ 5″	10′ 0″	7′ 0″	6′ 5″	7′ 9″
Maximum height ..	12′ 2″	8′ 4″	8′ 7″	8′ 4″	10′ 0″	11′ 1″	9′ 11″

A further trial of the same varieties has taken place in the short rains. A good deal of attention was attracted by these hybrid varieties of maize, particularly in regard to their early maturing properties, in which respect they were all but one superior to, and mostly much superior to Muratha. The only one comparing with Muratha in yield per plant is the Southern Rhodesia hybrid, which is just as slow maturing.

Similar trials were carried out at Nyeri and Machakos. At the former place the experiment was spoilt by the depredations of ground squirrels: Varieties W.59 and 9W however, showed merit.

Silicophosphate trials—Meru District.—Field experiments to test the value of silicophosphates, lime and the two together, were continued in the Chogoria area to test the residual effect of the applications made in October, 1947. Completely negative results were obtained in all cases under field conditions, although pot experiments carried out previously by the Soil Chemist had shown decided results.

Coffee trials—Meru.—Coffee variety trials, as such, have now been discontinued pending the arrival of a number of new selections from the Coffee

Research Station. Throughout these trials which have been carried on for eight years, Kent's have proved the best both in the mulched and unmulched plots. It is also the variety chosen for general planting. There would appear to be no object in continuing with the other varieties except for observational purposes. What we now require are a number of Kent's selections.

Pigeon peas—Kitui.—Two varieties of pigeon pea from India 1.P.41 and 1.P.80, alleged to be resistant to *Fusarium* wilt, have been tested on a plot known to be heavily infected. The plot was laid out with alternate rows of the local Kitui type. Both the Indian types have gone down badly with *Fusarium* and appear to be but slightly less susceptible than the local type, in addition to which the seed is very small and of unattractive appearance.

Blight-resistant potatoes—Embu.—The varieties 914, 834 and Salaman I have been grown with Kinongo as control in trials for yield and also for bulking purposes. They have yielded as follows in the long rains:—

914	13,968 lb. per acre
834	9,610 lb. „ „
Salaman I	6,633 lb. „ „
Kinongo	8,091 lb. „ „

The incidence of blight was very slight in the long rains at Embu and there is therefore little useful indication in this respect to record. There is a considerable demand for 914 seed in various parts of the district.

Beans—Embu.—The seven varieties of beans which were being grown in the last short rains yielded as follows, per acre:—

Plentiful	293 lb.
Granada	431 lb.
Michelite	495 lb.
Navy	238 lb.
Abundance	202 lb.
Rose Coco	362 lb.
Canadian Wonder	174 lb.

It will be seen that all varieties tried were superior to Canadian Wonder, which is one of the common beans of the district, but that the yields in most cases were low. The same varieties were planted again in the long rains but the trial was rendered completely useless by the depredations of buck. Further trials are being and will be carried out on these varieties and on some other indigenous beans which have appeared, particularly a red variety which is very popular in Embu, called Gatune, and Meru Yellow.

Cassava—Embu.—The yields of a variety trial harvested in February were as follows:—

Seseri	5,806 lb.
Mukabulu	6,034 lb.
Mkwekwe	1,310 lb.
F.279	2,740 lb.
Malindi	7,806 lb.
Mangi	1,029 lb.
Ankra	2,049 lb.
Korogwe	5,324 lb.
NK. 2	11,035 lb.

Many cuttings of Mangi failed to strike.

A further variety trial carried out in 1948 has not yet been harvested.

Burning experiments—Embu.—There are two burning experiments, at Embu and Mubuti wa Kathigi respectively. The various treatments have been carried out on these in their proper order, perhaps for the first complete year. No further

analyses were made on the Seed Farm burning experiment, but observations showed that the indications which appeared as a result of analysis last year have been borne out, and that red oat grass is coming in more and more on the annually burned plots. Those plots burned once a year look definitely more fertile than those burned twice a year.

Plot H, burned in alternate years, has now very largely reverted to tall bush.

At Mubuti wa Kathigi the only fact of which there is any very definite indication is that burning and cutting reduces the development of shrubs in the grassland. This experiment is just on the fringe of pure grassland country, and the same effect could very likely be produced by heavy grazing with goats.

Seed treatment trials—Embu.—Experiments were carried out with gammexane as a seed protection and also with 1 per cent D.D.T. mixture on young maize plants for control of stalk borer. The results are given in the table below:—

(*a*) *Gammexane—Per cent weevilled grains in 500 taken at random*

	Untreated		Treated	
	Per cent		*Per cent*	
Wheat	11		0	
Boston beans	—		14	Average 11·66
Abundance beans ..	—		13	
Canadian Wonder beans	—		12	
Plentiful beans ..	—		16	
Navy beans	—		8	
Michelite	—		7	
Rose Coco beans ..	67	Average 62		
Granada beans ..	57			

The period of this experiment was from 16th February, 1948, to 9th September, 1948. Thus gammexane very materially assists in storage of seed for six months, as might be expected.

(*b*) 1 *per cent D.D.T. mixture on stalk borer trials.*

	Height of plants	*Treated plants attacked*	*Untreated plants attacked*
I.	12″ ..	123 ..	147
II.	8″ ..	73 ..	244
III.	3½″ ..	14 ..	33

There is an indication here that D.D.T. should be applied to the plants in the early part of their lives.

Grassland experiments—Embu.—The rotational grazing experiment on the Embu Seed Farm, which was originally designed to support seven cattle on 3¼ acres by rotational grazing in four paddocks for periods of two weeks has carried on. It has been necessary to reduce the numbers of cattle to five, however, and even those have not always grazed in the paddocks as intended owing to failures by staff to understand what was meant and carry it out. Still, the indications are that on planted star grass pasture at the level of Embu Seed Farm, at least one cattle beast per acre can be carried, and probably more, provided that the paddocks are grazed in fairly rapid rotation.

A further grazing experiment has been carried out on the small-holding block. The five adult cattle which belong to this block have been grazing all the year on Rhodes grass and *Panicum mararikariensis* totalling approximately 2½ acres in extent. They have been tethered daily on the ridges which are planted to grass. These conditions approximate to a stocking of two beasts per acre.

The cattle when tethered not only ate the *Panicum makarikariensis* but appear to have caused a filling-up effect by breaking off parts of the tussocks and treading them underfoot so that they germinated. The grass is also running to some extent. The grass ridges on this area do not look anything like so heavily grazed as the star pasture in the paddocks above mentioned, and the cattle have remained in exceptionally good condition all the year through. The indications are that tethering on temporary leys might be superior to grazing in paddocks from the point of view of stock-carrying capacity, but it does also mean more labour and expenditure on ropes, etc. We are trying to get over the latter by the use of buffalo hide reims.

The results from these grazing experiments, though not conclusive, at least make it perfectly plain that the Embu tribe could maintain all their cattle easily, and enormously increase them in some areas, if they chose to eradicate the useless bush with which much of their land is clothed and replace it with well managed pastures.

Grassland experiments—Machakos.—By far the most attention with only one European officer here was given to consideration of grass improvement. The more the matter is investigated the harder it becomes. The aim in view may be reiterated:—

A high root frequency.
A high leaf/stem ratio.
A grazing period of not less than six months.
Persistence.
Close texture.
Soil protection.
Ability to withstand drought.

The emphasis is gradually shifting from the selection of a suitable variety to a search for the suitable management. One of the basic problems is solved if we can find a grass which can be practically established, meet our requirements, and answer the crying problem of the grass ley and at the same time provide adequate grazing on reasonable areas to support the arable requirements of grazing for manure-producing animals.

Although several grasses will grow in this district only three give solid grounds for hope. They are *Panicum mararikariensis, Cynodon plectostachium* and *Eragrostis curvula.* Both the former have to be planted at present and both require exceptionally careful management to become of value as soil improvers. *E. curvula* has not been tested sufficiently under arid area conditions.

Full scale trials on the cultural treatments required, manurial dressings and subsequent management are now being commenced.

Plant trials of the following crops were also undertaken at various stations: niger seed, English coriander, soya beans, bulrush millet, yellow maize (8 row Natal and Durum), buckwheat, safflower, sunflower, *Urena lobata,* rice, linseed and Canadian peas and pea beans.

Progress in Improved Farming

To report some progress again under this heading might lead the reader, if he were unacquainted with the condition of the African areas, to believe that it was only a matter of a few years before native agriculture was placed on a sound footing. Nothing, of course, can be further from the mark. Our problem, and no disrespect is intended, is like that of a small band of herds faced with the task of trekking an immense, sickly mob of cattle across the Northern Province at a time when water holes are drying up. What proportion of that mob will ever reach their destination in the time available? In our case what proportion of the African cultivators will "make the grade" before all is lost? The writer has come to the conclusion that the only sound future for the African lands of

Central Province is for those lands to fall into the hands of persons capable of farming them properly. We are gradually building up a small nucleus of progressive men from which more good farmers and good farming can emanate. There is no room for the absentee landholder who plants his land in the reserve up to wattle and then returns as a squatter to his adopted home, nor is there room for the lazy cultivator who through sheer idleness will not change his methods. Nor is there room on the land for the embryo trader, who, to bolster up his shop for which there is insufficient trade anyhow, milks his land unmercifully. For these reasons the tendency of the growing farmer class to purchase land and farm it well is welcomed. The main trouble with the African peasant is that he has not experienced the hard conditions of his counterpart in China and India. Nevertheless hardships are ahead and unless he is prepared to counter them with better farming methods he must inevitably lose his lands to his progressive neighbours, in which case permanent paid employment either in the reserve or outside will be his lot.

The progress that can be reported in 1948 is largely confined to the Kikuyu districts which areas are, of course, in greater need of better methods, and to the more congested parts of Embu District. These areas are paradoxically both understocked and overstocked at the same time. From both the nutritional and manurial standpoints the heavily populated areas do not possess sufficient stock for their requirements, but with the poor state of the grazing now available these areas are grossly overstocked for a considerable period each year. With correct farming methods and a proper balance between arable and grazing lands and the adoption of a certain proportion of stall feeding, there is little doubt that even the congested areas could support the existing population plus a considerable increase in stock. The question of what type of stock is dealt with later.

The use of manure, which is unfortunately still confined to a small proportion of the holdings, is, however, increasing each year and has spread very considerably from Kiambu District where it started.

In this respect the Senior Assistant Agricultural Officer, Fort Hall, writes—

> "This is the one direction in which real progress can be reported. In the higher areas paddocking is proceeding apace and the number of cattle sheds which have been built and are being used is legion. There is an ever-growing intelligentsia who appreciate the value of manure and demands for manure exceed the available supply manyfold.
>
> Grass is slowly but surely coming into its own and the principle of enclosure is gaining adherents almost daily.
>
> It is getting more and more necessary for Government to define its policy clearly regarding the continued introduction of grade stock into these high areas where they undoubtedly do well and are more economic, when fed and tended carefully, than indigenous stock."

In this district the demand for manure is to be partly met from compost factories, some of which commenced operations during the year. The purchase of manure by Kiambu farmers increases and although the cost is considerable it is an economic proposition because the district is the market garden area for Nairobi and its products command high prices. With a view to popularizing manure, importations from Naro Moru were arranged for South Nyeri District. The Karatina growers took advantage of this but those near Nyeri, for reasons best known to themselves, attempted a boycott. The latest indications are that the supply made available will now be taken up. It must be stressed that the importation of manure, except possibly in the case of Kiambu District, must be only a temporary measure. The home produced article is a better one and far cheaper. A manure scheme for Embu District is also being arranged, the considerable accumulations in the Mwea grazing area being the source of supplies.

As has been mentioned above a proper balance between arable and grazing land must be achieved, the temporary grass ley allowing the land to rest from crops and provide grazing for more stock so that more manure is available. At least amongst the Kikuyu tribe there is a growing awareness of the value of grass but our attempts to popularize the planting of grass will be made much easier if we can prove that the ley pays. The outstanding area in which a correct grass/arable ratio has been achieved is Ch. Muhoya's location in South Nyeri. That location possesses a large number of grade stock and these beasts, unlike the unimproved native types, are capable of converting grass into economical quantities of milk. Therefore if grass is to be made to pay improved stock must be made available not in ten years' time but now. A clear cut line of policy must therefore be laid down at high level as early as possible.

Many parts of the Kikuyu districts are well suited to dairy farming and within those districts there is a very large unsatisfied demand for milk.

There is one aspect of improved farming which has received too little attention in the past and that is the introduction of high priced crops. Such crops are vitally necessary to the economy of the native areas and it is hoped that the plans in train will materialize shortly.

Soil Conservation

District	Miles terraced	Acres terraced	Grass planted acres	Areas closed to grazing acres	Grassed run-ways	Compost pits used	Cattle sheds used
Meru ..	349	2,249	—	—	—	—	—
Embu ..	2,578	11,116	55	—	—	—	—
Nyeri ..	2,468	7,240	—	—	1,058	—	10,819
Fort Hall ..	2,076	7,183	—	—	3,081	21,913	2,843
Kiambu ..	3,000	10,399	1,500	—	529	—	—
Machakos ..	2,000	9,400	3,000	17,000	45	—	—
Kitui ..	564	3,542	3,150	—	—	—	—
1948	13,035	51,129	7,705*	17,000*	4,713*	21,913*	13,662*
1947	12,141	48,468	11,274	44,219	5,578	—	—

*Figures incomplete.

Terracing.—Continued progress has been made and in contrast to 1947, political activity has been far less. Nevertheless the repercussions of the trouble in Fort Hall during the previous year are still felt and terracing figures have never approached those achieved in that district earlier. Were this not the case the total miles terraced in 1948 for Central Province would have been materially greater. As it is the increase over 1947 was some 900 miles or a little over seven per cent. To make up for the Fort Hall deficit the greatest increases in terracing occurred in South Nyeri, Embu and Kiambu Districts which between them performed more than 2,438 miles over the 1947 total. The greatest increase took place in Embu where work was more than 100 per cent over the 1947 figure, but the most spectacular increase, judged by the changed appearance of the district, took place in South Nyeri. In addition to the figures shown in the above table South Nyeri completely renovated 546 miles of old terraces and Embu a large mileage which has not been estimated.

Meru.—The very short period between harvest and the next planting severely curtailed the terracing output; however, a successful campaign was held in September and October. Good work was performed in Chuka, Mwimbi and Imenti divisions and more progress than hitherto was achieved in the backward areas of

Tigania and Igembe. This district is fortunate in that over the major proportion of the area, with the exception of the northern grazing areas and Tharaka, a good bush cover exists on the non-arable portion and no terracing is necessary. This district reports a greater willingness to carry out terracing than was shown hitherto.

Embu.—A proportion of the increase in terracing results from the fact that all four locations in Embu division have now adopted the system begun in Ch. Muruatetu's location last year, of pegging and terracing all new land as soon as it is opened from bush. The system will be extended to other divisions but, where the population pressure is great, the terracing of new land alone is of course insufficient and old cultivation must be tackled at the same time. The system of giving instructors targets to peg without fail has worked well but checks by officers are essential. Generally it is felt that instructors have under-estimated rather than over-estimated acreages. There is still unfortunately too long a time lag between the pegging and the digging of terraces.

In general the maintenance of old terraces in Embu is good but this varies with the power and energy of the chiefs and headmen.

Nyeri.—Terracing work has made excellent progress, and shows a continued improvement in the monthly totals. The standard of work has been well maintained, and a simple system of size of terrace according to the gradient has been evolved and is in operation throughout the district, appearing to be satisfactory in practice. The standard of levelling by our staff at the opening of the year was deplorable, but refresher courses for all agricultural staff, run in conjunction with the Development and Reconstruction Authority Reclamation Scheme, have greatly improved the technique, though it still calls for improvement.

Large acreages of old and broken down terracing have been completely reconstructed, and in general, all terracing is being quite well maintained.

Fort Hall.—The Senior Assistant Agricultural Officer writes:—

> "It cannot be said that terracing has been a success this year. By dint of innumerable prosecutions and pressure in all directions, terrace output was stepped up to over 800 acres in September and October but fell again in November and December.
>
> "Communal effort is really a misnomer since the community consists of a few old, but willing horses and contains no women and few young men. These latter spend their time propping up coffee shops and when pressed merely vanish to Nairobi."

The problem in this district is a very acute one and the work of the agricultural staff, both European and African, is most unenviable. Mere mention of terraces creates a feeling of nausea. Some method whereby this unpopular but very necessary work can be completed and the equally important problems of good farming technique tackled is receiving a great deal of thought, but so far no solution has offered.

Kiambu.—Although the figures from this district show a considerable increase over 1947 the quality of work has deteriorated and the annual output per leveller has fallen almost by half.

The Senior Assistant Agricultural Officer writes:—

> "The chief cause for this landslide would appear to be the result of departing from the accepted system of communal work and introducing a system of individual orders. This was done in an effort to speed up work in the more difficult areas, but instead of proving effective it became a boomerang which, coming back at us, undermined the very foundations of our work.
>
> More terracing was obtained but the resultant work was so poor as to be useless; indeed it is a positive danger to us and a joy to the political

agitator, who can now ask what is the use of this work if terraces break with the first rain and indeed what use are they? Although the introduction of individual orders was the cause of bad quality, the actual reason was lack of supervision by levellers. Such supervision becomes impossible when individuals do this work at whatever time of day they like and more especially when the work is scattered north, south, east and west."

Efforts will be made to improve the position but the task will not be easy.

Machakos.—Work has continued on the *Utui* system and the acreage completed was approximately the same as in the previous year. The output per leveller is low in this district as the *Utui* are widely scattered and only about three can be covered by each man. The general attitude towards terracing in Machakos has continued to improve, but as has been mentioned in earlier reports terracing is only one of the many problems in this district.

Kitui.—The number of miles terraced in this district shows a further improvement and it is gratifying to report that the inhabitants have a growing appreciation of the need for this work. Progress has been restricted by the paucity of tools available, but since the end of the year this matter has been remedied.

Bench Terraces.—Quite obviously over large areas of the province bench terraces form the only ultimate solution to the soil conservation problem. There has been no effort to compel people to make these, but they are being brought to the notice of cultivators by demonstrations.

The Senior Assistant Agricultural Officer, Fort Hall, writes:—

"A few individuals have made bench terraces and there are signs that this method of soil conservation may take on well in the near future. Great care must be exercised in the original construction to ensure their permanency and fertility, but it is still difficult to make the African appreciate that the extra work of pulling down the topsoil to cover a newly made terrace is well worth while and, indeed, essential if the bench is to be cropped immediately.

Many of the chiefs' camps now have demonstration bench terraces which, since they are not being pushed, are arousing keen interest.

Adequate protection against the ravages of stock is absolutely essential if benches are to stand the test."

And from Embu comes the following:—

"Certain areas in Mbere where there are plentiful supplies of stone are to be bench terraced in future. There is interest in bench terracing displayed by some the more intelligent individuals and schools, etc., and it is undoubtedly the best policy for the future. Next year it is proposed to lay out bench-terracing demonstrations at all chiefs' camps and wherever possible schools will be encouraged to make bench terraces on their *shambas* instead of narrow-base terraces. The bench terrace cannot of course supplant narrow-base terraces in areas where shifting cultivation is still practised at a fairly rapid rate, but there is no reason why the more progressive should not use it."

Reclamation.—In Embu reconditioning of eroded areas in the Mwea, Gitige Hills and elsewhere has continued. In the Mwea ploughing on the contour and subsequent seedings with indigenous grasses produced indifferent results in the long rains, but good short rains gave success to the method. The area planted in this way during 1947, or alternatively planted to *Cynodon*, now has a good cover and the general progress in this area is really astonishing. Results have also amazed the local people who have shown admirable co-operation. They will be rewarded by further reopening of previously closed areas. Results in the Gitige

Hills are very much the opposite and the stubbornness of this soil is incomprehensible and it appears to be about impossible to cover it.

In South Nyeri five paid gangs were employed at the end of the year and have done excellent work on the Sagana, Chania and Gura valleys, which were beyond the capabilities of *Gĩtati* labour. This work is most noticeable to persons passing through the district and has excellent propaganda value. The recovery of certain areas planted to grass in the long rains has astounded the local people. Unfortunately grass-planting conditions were not ideal and much of the reclaimed areas await further attention in this direction during the 1949 long rains.

In Fort Hall five paid gangs were working during the first half of the year, but the number was reduced to four during the second half. These gangs were employed on grass planting and dam making in addition to normal reconditioning work on the Gaturi hills and elsewhere.

Grass Planting.—Good progress in this direction is reported from Meru District, and during the periods when arable land is under crops and terracing therefore comes to a standstill grass planting is undertaken when conditions are suitable.

In Embu, with the exception of the Mwea which has already received attention, progress was not satisfactory and the two grass-planting weeks organized largely failed through lack of support.

South Nyeri cultivators made a good response to the grass-planting campaigns, and although weather conditions were far from ideal progress was achieved. The paddocking of planted grass is increasing rapidly and as the fences appear so does the quality and management of the pasture improve.

In Fort Hall considerable grass planting took place during both rains, but results in the lower areas, where heat, white ants and impoverished soil prevail, were disappointing.

The Senior Assistant Agricultural Officer, Kiambu, writes:—

> "Grass is replacing wattle on slopes, most noticeably so in both Waruhiu's and Magugu's locations. Much has been planted along the rivers in Chief Joshia's location. Generally speaking, however, cultivation along river banks is far too often met with and there is little real desire on the people's part to stop it."

Machakos District continued with the planting of *Cynodon* on bare areas and this species must be used until some better one is found if such exists. Properly managed this grass produces an excellent cover, but controlled grazing within the Machakos area is difficult.

Bush Clearing and Improvement of Pastures.—The progress in Meru District is a noticeable feature and the chiefs responsible are to be congratulated on their efforts. Very large areas of bracken and useless weeds and bush have been cleared with a view to establishing pastures.

South Nyeri reports as follows:—

> "Our most vigorously conducted campaign of the second half of the year has been to try and get pastures, being rapidly smothered in all areas, cleared of Mexican marigold and sodom apple. This evil has been encroaching for years and leading to ever-increasing concentration of stock on the diminishing pastures still grazeable, resulting in denudation and the commencement of new foci of erosion.
>
> Good progress is now being made by communal groups composed mostly of old men and women who are not called upon to do communal terracing work.

The most difficult weed to eradicate is sodom apple, which if not grubbed out rapidly shoots again. It is therefore planned to purchase a considerable number of mattocks in 1949 from the Development and Reconstruction Authority funds to aid the groups in this work. Bracken eradication in the higher zones is also progressing favourably."

Tree Planting.—Meru reports not only a very sane attitude to the care of the excellent indigenous trees of that district but a marked response to further tree planting. In Nyeri vast numbers of trees are taken annually from the forest nurseries, our few small nurseries as well as several commercial concerns run by Africans. Obviously the last mentioned means that there is a genuine desire to increase the numbers of trees in the reserve.

Tree planting on the Gaturi hills in Fort Hall met with only partial success and the ultimate solution for this stubborn area has yet to be found. A fruit orchard was commenced at Kanyenyeni and a number of types of deciduous fruits are under trial.

Issues of trees are made from a number of nurseries in Machakos District, but the rate of survival is low through adverse climatic conditions and lack of care.

Water Supplies and Protection of River Banks.—In Meru the protection of springs continues, and much to the delight of the local inhabitants areas similarly protected in past years have resulted in long-forgotten springs and streams bursting forth again, whilst in other cases water in existing courses has increased.

A new Embu Local Native Council resolution for the protection of the banks of temporary streams was passed during the year. If this is put into effect efficiently further protection of the water resources will be achieved. *Paspalum notatum* has been planted widely to provide a reservoir of material for the protection of stream banks and for bench terracing.

In the steeper parts of the Kikuyu country much erosion caused by the movement of cattle and many hours of human effort would be obviated if water could be brought to the tops of the ridges. Such schemes are likely to be expensive, but a start should be made on one or two if only as initial trials. Such a scheme in South Nyeri still awaits the arrival of the Hydraulic Engineer of the Development and Reconstruction Authority.

The Senior Assistant Agricultural Officer, Kiambu, writes:—

"River banks now have some degree of protection except in the more densely populated areas. Here, with dwindling fertility on eroded hillsides, the valley bottoms and stream banks are the only places where food can be grown. There is, therefore, the greatest reluctance on the part of the landowners to surrender even an inch of river bank."

Two dams were constructed in Fort Hall and a third started. The Agricultural Department's Dam Unit arrived in Machakos District in October and commenced work on a programme of a number of large-sized dams. Some difficulties were experienced at the start and the provision of adequate water for the consolidation of the dam walls appeared the most serious. These difficulties were gradually overcome and the fencing off of the catchment areas is now in hand. The ultimate benefit which will accrue to the district must depend on an intensification, rather than a lessening, of the campaign to construct small ox-made dams ringing the larger types. Five successful small dams were constructed during the year and another three are nearing completion.

In Kitui three boreholes were successfully completed and drilling on a further one continues. Three others were fitted with hand pumps. Ten dams were completed, but two of these burst with the unprecedented volume of water during the short rains.

General.—The year has shown considerable progress in the adoption of better soil conservation technique, but the full force of the various schemes financed from the Development and Reconstruction Authority has yet to be felt. It is sincerely hoped that reasonable political stability can be retained, and therefore the co-operation of the people, so that the various schemes can achieve their object, that is the increase in tempo of all soil conservation work. For some years now the vast proportion of the time of all agricultural staff has been spent on soil conservation in some form or other. This very essential work is, of necessity, highly irksome and officers in the field, as well as all African staff, must be congratulated on their unremitting efforts in this direction. When progress is achieved there is always the spur to further goals, but when terracing figures decline or the quality of the work is imperfect those in charge experience depression and cannot help but wonder whether the terracing campaign will last for ever. To enable the Department to divert its attention to other aspects of better farming two things are first of all essential:—

(*a*) The completion of terracing on all land that needs it.

(*b*) The maintenance of those terraces by the people without intensive campaigns as a matter of routine, just as digging, planting, weeding and harvesting are matters of agricultural routine.

Agricultural Education

Agricultural School, Embu.—The Embu Agricultural School continued to be run on the seed farm throughout the year, the building at Kangaro site having been held up. There were 22 apprentices and Mr. Samuel Mbugua was in charge with Mr. Peter Kamau to assist him.

At the new school site at Kangaro work has consisted of digging couch out of tree plantations, keeping a nursery going and clearing a part of the experimental block. Certain areas were also fenced off for paddocks, which are grazed by herds of local cattle which supply a good deal of the milk required by Embu Boma and a lot of useful manure besides keeping down the bush. It is planned to increase the paddocks and stocking in January, 1949, and to complete the first clearing of the experimental block. Unfortunately, owing to years of delay, this will be a very much more expensive operation over the whole area than otherwise.

Building of the new school commenced in the second half of the year and it is hoped that all work will be completed by the middle of 1949.

Education Department and Mission Schools.—Routine visits were made to schools in all districts. It is very gratifying to report that excellent progress on school gardens has been made in Meru and Fort Hall Districts. In the former district the appearance of some of the plots, particularly in the Chuka–Mwimbi divisions, affords an excellent demonstration of sound farming and tidiness. In Fort Hall District school sites are generally only to be found on the barren hilltops for which the local inhabitants had little use. Nevertheless, efforts in the form of bench terraces, paddocks, etc., have been made to improve the land.

At Kitui an area of 25 acres attached to the Kitui Primary School has been fenced and is being developed on mixed farming lines with the assistance of the Agricultural Department when required. In this district also, at the instigation of the District Commissioner, each elementary school has been provided with 20–50 acres which is being cleared of bush and on which, wherever practicable, a small dam will be built. It is hoped thus to teach the elementary principles of animal husbandry with which a district such as Kitui is so closely bound up.

In South Nyeri District an agricultural refresher course for 26 African headmasters of all denominations was held by the courtesy of the Church

of Scotland Mission, Tumutumu, at their mission headquarters from 16th August, 1948, to 21st August, 1948. The mission kindly provided accommodation free (it was during school holidays) and also made all cooking and messing arrangements.

The aim of the course was not to try and teach agriculture as an academic subject in a week, but to "sell" farming to these teachers as an interesting and attractive profession and to give them an idea of what is implied by agrarian development as set forth in the Nyeri Agrarian Plan.

The course consisted of lectures and discussions in general terms rather than on specific subjects, lectures by officers of other departments to show how the Government team links up and numerous visits to various works on the "walk and talk" principle. The only "taboo" was politics.

It is safe to say that the course aroused considerable interest, and it is hoped to be able to put on another during 1949 to which it is suggested that a mixed class of teachers, chiefs, departmental staff and progressive, educated farmers be invited.

Agricultural Literature.—There is an increasing demand for simple books on agriculture and the series written by Mr. Humphrey will fill a much-needed want. Although literature can never replace personal contact and advice in the field there will in due course be need for an advisory service for African farmers.

Agricultural Shows.—The policy in Central Province has been to concentrate on district shows as opposed to a provincial show and it is felt that this policy was very amply justified by the shows held in 1948. Attendances were generally very satisfactory and it is certain that both entertainment and agricultural education were brought to a larger number of people over a far wider area than would have been the case if a provincial show had been held in their place. With one or two exceptions these shows raised a great deal of enthusiasm amongst the exhibitors and those who attended and the results can be nothing but good.

One aspect deserves mention, and that is the organization necessary. With the African at his present state of development very little of the real work behind a show can be relegated to him. This means that at least one European officer is fully occupied for a month or more on duties solely connected with the show, during which time his district activities must suffer. On balance, however, there is little doubt that a successful show warrants the risk of district work falling behind. A less parsimonious allocation of funds for shows would relieve officers of considerable financial worry.

Communications

The general condition of the main roads of the province has shown little improvement and leaves much to be desired. Reserve roads are generally very poor and movement during the rains is severely restricted. In the case of the latter little improvement can be expected until the necessary funds are available. Local native councils are giving the matter attention and some mechanical plant for road construction and maintenance has been acquired.

The provision of diesel cars on the railway would relieve the roads of some of the decrepit native buses which operate to the danger of the users and other traffic and would also assist with the movement of perishable produce.

Telegraphic and postal communications have deteriorated and the delay in transmission and delivery of telegrams is in some cases considerable. A number of official letters have failed to reach their destinations and others have travelled by circuitous routes (one voucher eventually reached its recipient with a Madras postmark). The apparent necessity for registering important official communications is irksome and should be unnecessary

Applications to install telephones in the Meru, South Nyeri and Karatina offices were turned down, but an instrument is now available in the Fort Hall office. It is hoped that the above defects will be remedied in 1949. Telephonic communication to Embu would be exceedingly useful.

Pests and Diseases

Vermin.—Poisoners have continued to work in some districts with success and in this way the numbers of pig, porcupine, monkeys, baboons, etc., is kept within reason. A plague of ground squirrels at Nyeri was more difficult to deal with and a supply of "jaw" traps is needed. At Kitui grain-eating birds were exceptionally numerous when the bulrush millet and sorghum were ripening in January and February.

Pests.

Locusts.—The province was free from locusts during 1948.

Mealy Bug.—Minor outbreaks of the coffee mealy bug occurred in Meru, South Nyeri and Fort Hall but were never serious. The large Australian mealy bug was prevalent on citrus in Kiambu District.

Stalk Borer.—Was fairly prevalent in Embu, Fort Hall and Kiambu Districts, but was only serious in the last district towards the end of the year.

Bean Fly.—Caused losses in South Nyeri and appears to be on the increase.

Plum Borers.—A species of Ceramcycid larva has done some damage to plums in Fort Hall District.

Army Worm.—The southern part of Machakos and part of Kitui District experienced a serious attack in November, but as usual this pest disappeared as quickly as it came.

Fruit Scales.—Both brown and green scale were reported on citrus in Kiambu.

Frog-hoppers.—Attacked wattle around Limuru and Kiambu.

Aphis.—Were evident on brassicas during the hot weather.

Diseases.

Fusarium Wilt.—Generally speaking this disease was less prevalent than usual and losses were below average. Embu, however, reported up to 20 per cent losses from this disease.

Potato Blight.—This disease was very prevalent once again in South Nyeri and Kiambu and immune varieties have therefore been in great demand.

Cassava Mosaic.—Is generally present to a greater or lesser degree on all cassava but appears to be serious only where soil fertility conditions are low.

Maize Leaf Streak.—Was generally less prevalent than in 1947.

Mildew.—Occurred in serious proportions on green gram in Mbere and caused a 50 per cent loss of crop in some cases. Mildew also caused damage to beans and peas in Kiambu.

Noxious Weeds.—The campaign against *Datura stramonium* continues and in most districts its prevalence is less noticeable. In Kiambu, however, it is reported to be on the increase. Campaigns to eradicate bracken, sodom apple and Mexican marigold continue or have been commenced in Nyeri, Meru and Embu. The intensive 1947 campaign in Embu has largely died down through the lack of interest shown by chiefs and headmen, but excellent work is being done in Nyeri and Meru. The line taken is that good pastures are far better than weed-infested wastes and there has been good response to our directions in these two districts.

General

The year produced no spectacular progress, but there is little doubt that the groundwork for important developments has been laid. Future progress, very naturally, depends on to what extent we can persuade the African to adopt the new methods advocated and how quickly. In this, development is so closely bound up with political activity. If the agitator gains ground delay in agricultural progress is certain. There are signs, however, that agriculture is getting a hearing now and the more intelligent persons connected with the land see through the professional agitators' promises. Mixed farming methods are being adopted slowly and some of the farmers concerned reap considerable financial benefits.

The quality of the African staff varies between districts, but mention should be made of the high prestige enjoyed by our instructors and others in Meru District. The award of the British Empire Medal to Mr. Shadrack Munyi was as popular as it was deserved and he is to be congratulated on his outstanding loyalty and devotion to duty.

Finally, both the Provincial and District Administrations are sincerely thanked for their ever-ready co-operation and sympathy with our difficulties, thus bringing about a most happy relationship between Administrative officers and officers of the Agricultural Department in the field.

J. T. MOON,
Senior Agricultural Officer,
Central Province.

APPENDIX I

Rainfall

District	Centre	1946	1947	1948
		in.	in.	in.
Meru—	Meru	54·13	62·39	63·21
	Chuka	50·58	78·42	64·83
	Oringo	47·80	51·10	49·38
	Maua	—	—	93·86
	Tharaka	—	—	50·56
Embu—	Embu	48·34	52·47	39·66
	Kerugoya	—	72·38	46·96
	Sagana	34·03	68·66	32·91
	Mulingari	19·07	57·73	35·77
	Kabondori	—	—	47·32
	Ishiara	25·00	43·80	34·45
S. Nyeri—	Nyeri	25·61	50·54	26·95
	Othaya	41·07	60·42	44·54
	Mukuruweini	53·57	69·99	41·85
	Karatina	52·41	63·04	52·81
Fort Hall—	Fort Hall	47·13	51·75	52·08
	Muriranjas	62·08	72·18	60·80
	Kanyenyeni	74·52	87·23	66·74
Kiambu—	Kiambu	37·25	57·74	33·70
	Githunguri	48·54	67·49	36·68
	Gatundu	46·45	55·87	42·67
	Chura	32·39	47·33	37·07
Machakos—	Machakos	27·13	48·63	36·96
	Matungulu	—	—	39·39
	Matiliku	30·32	35·42	30·64
Kitui—	Kitui	37·92	37·51	52·39
	Migwani	—	39·50	45·09
	Kanziko	—	—	25·06
	Mutomo	—	32·07	32·50
	Mivukoni	—	—	41·28

APPENDIX II

Expenditure and Revenue, 1948

Agricultural Department	*Expenditure*			*Revenue*		
	£	s.	cts.	£	s.	cts.
Meru	1,582	8	43		—	
Embu	3,670	15	43	24	8	65
South Nyeri	2,749	0	98		—	
Fort Hall	2,069	17	39	35	17	00
Kiambu	1,946	7	22		—	
Machakos	2,138	12	69		—	
Kitui	699	15	00		—	
Total ..	£14,856	17	14	£60	5	65

Local Native Councils	£	s.	cts.	£	s.	cts.
Meru	4,682	1	07	10,109	10	44
Embu	4,213	1	63	25,395	2	38
South Nyeri	4,043	11	28	4,545	0	30
Fort Hall	2,229	8	57	16,401	11	73
Kiambu	3,059	5	14	3,021	16	48
Machakos	2,167	12	32	490	13	53
Kitui	615	0	00	192	0	00
Total ..	£21,010	0	01	*£60,155	14	86

D.A.R.A.	£	s.	cts.	£	s.	cts.
Meru	376	12	00		—	
Embu	497	15	11		—	
South Nyeri	1,585	17	18		—	
Fort Hall	4,796	18	97		—	
Kiambu	2,775	17	78		—	
Machakos	4,032	13	57		—	
Kitui	80	15	00		—	
Total ..	£14,146	9	61		—	

* Includes Betterment Fund.

Total Revenue	£60,216	0	51
Total Expenditure	£50,013	6	76
Excess of Revenue over Expenditure	£10,202	13	75

ANNUAL REPORT OF THE SENIOR AGRICULTURAL OFFICER, COAST PROVINCE, 1948

Staff

European.

Mr. M. H. Grieve, Senior Agricultural Officer, throughout the year.

KILIFI (including Malindi and Kaloleni).

Mr. R. O. Williams, Agricultural Officer, 1-1-48 to 2-9-48.

Mr. L. B. L. Evans, Assistant Agricultural Officer, 1-1-48 to 31-12-48.

Mr. V. C. St. G. Giffard, Assistant Agricultural Officer, 1-1-48 to 16-10-48.

Mr. A. L. McConnell, Assistant Agricultural Officer, 17-10-48 to 31-12-48.

Mr. M. H. Sturt, Assistant Agricultural Officer, 10-11-48 to 31-12-48.

Mr. A. S. Leask, Assistant Agricultural Officer, 16-12-48 to 31-12-48.

Mr. G. W. Jeffrey, Temporary Entomologist, 1-1-48 to 31-12-48.

KWALE.

Mr. E. C. M. Green, Assistant Agricultural Officer, 1-1-48 to 22-4-48.

Mr. J. A. Allan, Pasture Research Officer, 23-4-48 to 31-8-48.

Mr. G. Beverly, Assistant Agricultural Officer, 1-9-48 to 31-12-48.

Mr. H. J. York, Assistant Agricultural Officer, 1-1-48 to 24-5-48.

Mr. A. L. McConnell, Assistant Agricultural Officer, 1-1-48 to 12-8-48.

MATUGA.

Mr. A. L. McConnell, Assistant Agricultural Officer, 13-8-48 to 16-10-48.

Mr. A. R. K. Gibbs, Assistant Agricultural Officer, 12-10-48 to 31-12-48.

Mr. A. C. Howden, Assistant Agricultural Officer (Horticulture), 20-12-48 to 31-12-48.

VOI.

Mr. G. B. Rattray, Agricultural Officer, 1-1-48 to 31-1-48.

Mr. S. D. Goodwin, Assistant Agricultural Officer, 1-2-48 to 31-12-48.

Mr. H. J. York, Assistant Agricultural Officer, 25-5-48 to 31-12-48.

TANA RIVER AND LAMU.

Mr. J. E. L. Fenner, Assistant Agricultural Officer, 26-2-48 to 5-8-48.

Asian.

Mr. W. R. Sethi, Agricultural Assistant at Gedi throughout the year.

Mr. Abdul Karim, clerk to the Senior Agricultural Officer, Mombasa throughout the year.

African.

Mr. David Mbotela, African Agricultural Assistant, at Kibarani, 1-1-48 to 22-8-48.

	A.D.	*L.N.C.*	*Total*
Clerks	5	—	5
Agricultural Instructors	66	—	66
Assistant Instructors and Produce Inspectors	—	8	8
Soil Conservation Staff	—	43	43
Labour	126	53	179
Sundry Semi-skilled Employees ..	10	2	12
Total ..	207	106	313

Travelling

During the year the miles travelled by officers on duty were as follows:—

Senior Agricultural Officer, Coast	7,544 miles
Agricultural Officer, Kilifi, and Assistant Agricultural Officer, Kilifi	7,982 miles
Assistant Agricultural Officer, Malindi	2,444 miles
Assistant Agricultural Officer, Kaloleni	4,160 miles
Assistant Agricultural Officer, Kwale	4,275 miles
Assistant Agricultural Officer, Teita	4,800 miles
Assistant Agricultural Officer, Kipini	3,000 miles
Agricultural Assistant, Gede	3,644 miles

Seasonal Conditions

Throughout the province the first three months of the year were, as is usual, hot and dry. The long rains broke at the beginning of April and in the coastal strip and the Teita hills continued satisfactorily during May and June; in the hinterland they were inadequate and the greater part of the maize crop failed in consequence. From July to the end of October only ineffective light showers fell anywhere, and even in November rainfall was sufficient only in the Teita hills. Good rains fell over most of the province during December.

RAINFALL

	1948	*1947*
Lamu	27.76	39.54
Kipini	30.08	—
Malindi	42.93	65.99
Kakoneni	16.62	—
Marafa	26.47	37.51
Kilifi	30.00	59.90
Bamba	17.00	34.18
Mombasa	47.00	74.07
Kwale	50.27	—
Tiwi	44.92	—
Msambweni	82.22	102.10
Samburu	25.00	—
Gazi	67.10	—
Waa	44.65	—
Kinango	29.48	44.98
Vanga	59.76	—
Voi	16.61	20.42
Wundanyi	52.73	52.96
Taveta	21.04	48.50

Production

Crops.

Beans.—Beans are only grown to an appreciable extent in the Teita hills where yields from the 1947–48 short rains crop were good. Heavy rains during April and May reduced the long rains crop to below average, but prospects for the short rains plantings were good at the end of the year.

Cashew Nuts.—The 1947–48 crop, most of which was bought during the first three months of the year, totalled 2,203,054 lb. and producers received 10 cents per lb. at all buying posts. Heavy rains coincided with the flowering period and greatly reduced the setting of the fruit, and the 1948–49 crop will be considerably less than the previous one. Buying started in the middle of December at 10 cents per lb. at buying posts, 12 cents per lb. at Kibarani factory.

Cassava.—The staple crop of the Wadigo and grown to some extent by the Giriama of the coastal strip. In these areas crops generally were good but would have been improved by more care and attention. In the hinterland cassava was not grown to the extent it should be and most of the comparatively small acreages planted were badly damaged by stock ranging free after the cereal crops had been harvested.

Chillies.—245,913 lb. of chillies were exported during the year from Voi District, where they constitute the main source of cash for the people of Mwatati and Kasigau. Quality was fair but needs improvement by greater care in picking. The average price to the grower was Sh. 26 per frasila.

Coco-nuts.—Due apparently to unfavourable climatic conditions the crop was somewhat below average in most areas. Pressure to increase the acreage was maintained throughout the year and met with some little success. Coco-nuts are considered by the growers to be a food crop rather than a cash crop and until marketing of copra is organized on a firm basis to ensure that the producer gets a fair price for good-quality produce the cash incentive to increased planting will be lacking. The amount of copra bought by the Control during the year fell to 734 tons, although no doubt a great deal more was marketed.

Coffee.—Large numbers of seedlings of the two varieties D.R.2 and S.L.28 were raised in the Wundanyi nurseries. The Wateita, however, evinced no enthusiasm for coffee planting entailing bench terracing, proper holing out and manuring, and at the end of the year had only planted rather more than three acres, most of which was doing well. It is likely that until cash-in-hand results from early plantings produce there own evidence the progress of coffee planting will be slow.

Cotton.—Final figures for the 1947–48 crop were:—

	A.R.	*B.R.*
Malindi	1,426,972 lb.	78,793 lb.
Lamu	78,904 lb.	1,402 lb.
	1,505,876 lb.	80,195 lb.

Most of the 1948–49 crop was planted during May, although there was a tendency to prolong the planting season unduly in some places. There was a considerable increase in acreage presumably due to the early announcement of an increased price to 30 cents per lb. for "A" grade as compared with 22 cents for the previous year. Growing conditions were good, and in spite of little care being given to the crop by the growers it did well and was comparatively free from insect pests. Buying started on 29th November and at the end of the year 2,219,706 lb. of "A" grade had been bought.

Fruit.

Bananas.—Were the only fruit of which a considerable surplus was sold during the year, mostly in Mombasa and Mackinnon Road.

Citrus.—Was poor in quality, but maintained more than a reasonable price owing to demand exceeding supply.

Mangoes.—A very small crop was harvested, mostly in the Lamu and Malindi areas; the quality of the recognized named varieties was excellent.

Pine-apples.—Great interest in pine-apple growing for canning was displayed by a number of European and Indian landowners in the Voi and Kilifi districts and considerable development work was undertaken by them during the year.

Groundnuts.—Some increase in the growing of Bambara groundnuts took place in Digo District. No success attended attempts to extend the growing of the ordinary groundnut in Kilifi District.

Kapok.—A considerable number of seedlings were raised and distributed in suitable areas during the year. The total 1947–48 crop from African producers was 33,397 lb. bought at 30 cents per lb. and approximately 18,000 lb. of the 1948–49 crop had been bought at the end of the year at 35 cents per lb.

Legumes.

Cow-peas.—Good crops were harvested in most areas and a good deal of internal movement took place to supply local shortages.

Green Gram.—A fair crop was harvested from a small acreage.

Maize.—Good crops were harvested in both seasons in the Teita hills and the coastal strip, but as is usual crops in the hinterland varied from very poor to complete failure. Seventy bags of yellow durum maize were bulked at Kibarani for distribution.

Millets.—Except at Gedi Settlement where small acreages of foxtail millets were grown the amount of millet grown was negligible.

Potatoes, English.—Small quantities were marketed in the Teita hills from a small acreage which was heavily attacked by phytophthora. The blight-resistant varieties 914 and 835 were grown on the Wundanyi farm for distribution.

Potatoes, Sweet.—Are grown over most of the province but nowhere in quantities sufficient to provide an adequate food reserve. No increase of acreage is reported during the year.

Rice.—Although the acreage planted this year showed a considerable reduction, due to less rain with consequently small available areas of swamp, good crops were grown and made a substantial contribution to the food supplies. There is a welcome tendency for the cultivation of rice to spread to localities which hitherto have not grown it.

Simsim.—Only a very small acreage of the black-seeded variety was grown in the Malindi area; yields were moderate.

Sisal.—A European- and Indian-grown plantation crop, which enjoyed a prosperous year. A great deal was done on most estates to renovate areas unavoidably neglected during the war and considerable acreages were cleared for new plantings.

Sorghum.—Only the Waduruma grew an appreciable acreage and efforts to popularize the proved short-term variety, dwarf hegari, met with little success, partly on account of the general preference for maize as a diet and partly owing to the necessity for bird-scaring if any grain is to be harvested. Bulking of this variety was, however, continued during the year.

Sugar Cane.—The Kenya Sugar Company at Ramisi had a successful year and cleared a considerable acreage for planting. Large acreages of cane were grown in the Teita district and considerable quantities in other areas. Although its main use there is for making beer it also serves as a useful supplement to the children's diet.

Tobacco.—The Lamu crop amounted to 16 tons of Grades 2 and 3, valued at Sh. 33,890, and was bought by the British-American Tobacco Company for export to Somaliland for the manufacture of snuff. The numerous tiny patches grown throughout most of the rest of the province produced small surpluses which sold for snuff making at from 50 cents to Sh. 1 per lb. according to the method of curing.

Vegetables.—Dry weather at the beginning of the year retarded production in the Teita hills, but sales for the year ultimately exceeded those of the previous year by some 200,000 lb. In spite of the continued propaganda for a more varied selection the growers continued to rely mainly on cabbages and carrots.

The following figures relating to vegetables exported from the Teita District for the year show an increase over the previous year:—

	Exports	
	1948	*1947*
First quarter	394,502 lb.	103,425 lb.
Second quarter	391,714 lb.	270,873 lb.
Third quarter	546,729 lb.	562,798 lb.
Fourth quarter	452,812 lb.	636,768 lb.
Totals ..	1,785,757 lb.	1,573,864 lb.

Livestock.—The much to be desired expansion of the livestock industry continued to be prevented by lack of water supplies, by tsetse fly and by the increase of east coast fever.

Produce Inspection

Inspection rules under the Crop Production and Live Stock Ordinance are not applied to Coast Province and inspection services do not exist. A check was, however, kept on the quality of cotton, cashew nuts and vegetables marketed. The quality of most of the copra sold was poor, and of the maize and legumes sold for local consumption worse.

Marketing

Organized marketing was only applied to cotton, copra and cashew nuts, although considerable quantities of maize, legumes, bananas, rice and other foodstuffs changed hands and were moved within the province throughout the year. In the absence of a complete and reliable organization for recording the amounts of produce marketed it is in some cases only possible to give estimates.

Produce	*Quantity*	*Approximate Value* £
Cashew Nuts, 1947–48 Crop ..	2,203,054 lb.	11,000
Chillies	245,915 lb.	7,800
Copra	734 tons	21,300
Cotton, 1947–48 Crop A ..	1,505,765 lb.	15,300
Crop B ..	80,193 lb.	
Kapok, 1947–48 Crop	33,397 lb.	500
Sisal	10,152 tons	800,000
Sugar	4,241 tons	111,000
Tobacco	33,890 lb.	1,700

The above are from actual returns and represent revenue accruing to the producer. The figure for copra should probably be doubled.

The following are estimates, except in the case of vegetables, and represent a redistribution of cash already in the province between one district, or part of a district, and another, and in the main between Africans:—

Produce	Quantity	Approximate value
		£
Betel leaves	—	2,000
Cassava	100 tons	400
Coco-nuts	1,000,000 nuts	5,000
Cowpeas	9,000 bags (200 lb.)	11,000
Fresh fruit	5,000 tons	30,000
Green gram	2,000 bags (200 lb.)	6,000
Maize	20,000 bags (200 lb.)	25,000
Maize bran	24,000 bags (70 lb.)	5,000
Rice (paddy)	21,000 bags (160 lb.)	42,000
Simsim	1,000 bags (180 lb.)	2,000
Sweet potatoes	40 tons	200
Tobacco (local)	50,000 lb.	2,000
Vegetables	1,785,757 lb.	8,000
	TOTAL	£138,600

Famine Prevention and Relief

Propaganda to increase drought-resistant crops continued without any marked success. Local food shortages were alleviated by internal movement of surpluses and by the importation of 60,295 bags of maize meal.

Crop Improvement and Investigation

Crop improvement was confined to the bulking and issue of yellow durum maize, dwarf hegari sorghum, cassava, groundnuts, blight-resistant potatoes and rice varieties. Nurseries of selected coco-nuts, kapok and mangoes were established and issued a number of seedlings.

The following table shows quantities of seeds issued in 1948 and quantities produced in 1948 for distribution later:—

	Seed issued in 1948 (bags)	Seed produced in 1948 for distribution (bags)
Maize Yellow Durum	26	89
Sorghum Dwarf Hegari	36	89
Groundnuts	40	3
Potatoes	6	6

Investigational work included trials of sunn hemp, *Urena lobata*, sunflowers, soya beans, pigeon peas, groundnuts and a number of grasses.

Progress in Improved Farming

Very little progress was made in overcoming the resistance of the African to adopting improved methods except those enforced as soil conservation measures (*see* next section). No success has yet been achieved in encouraging the use of manure.

Soil Conservation

Considerable progress was made in the closure of very steeply sloping land to cultivation in the Teita hills and the southern Kilifi highlands in the face of some opposition which necessitated a number of prosecutions. While it cannot be said that these measures received any support from the people involved, they were at least looked upon in the small areas of Kilifi District where they are applied as inevitable. In the Teita hills it has not been possible to close anything but the very steepest slopes.

The laying of trash lines has gained ground throughout most of the province and some improvement has been achieved in size and technique. Over 1,000 miles of trash lines were laid down in the Teita hills where the method has the support of tradition. In some cases land which was trash lined a few years ago and on which the lines have been properly maintained has made perceptible progress in the formation of bench terraces by natural movement of the soil, assisted to some extent by hand digging.

In the Teita hills reconditioning has been directed towards grass planting, the closing of steep paths and cattle tracks and the stopping of gullies. Some 25,000 tree seedlings were issued. Three earth dams were made and at the end of the year a fourth was nearing completion.

In Kilifi District three dams were built.

Agricultural Education

Kibarani School was reopened and ten pupils successfully completed the first year of the two-year course. Throughout the province officers and instructors visited schools and gave talks and advice on agricultural subjects.

Communications

Lamu District was as usual cut off for a long time by the flooding of the road north of Garsen, and roads in the Teita hills and Digo District were impassable from time to time. Even when all roads are open and passable the province is not well served for communications.

Pests and Diseases

Army worm caused some damage in the Malindi area at the beginning of the year.

Aphis attacked vegetables in Teita.

Mosaic was prevalent in cassava.

Pink ear rot, stalk borer and smut were present in varying degrees in maize, but did not affect yields to any extent.

Stainers were prevalent in cotton.

General

Some 2,000 acres of very suitable land at Matuga on the mainland ten miles south of Mombasa were earmarked for use as an agricultural training and experimental station and preliminary work on survey carried out. Two temporary wattle and daub houses were built.

The Agricultural Settlement Scheme continued at Gedi and in Voi District funds from the African Settlement and Land Utilization Board were used for staff and materials to expedite soil conservation.

A. W. THOMPSON,
Acting Senior Agricultural Officer,
Coast Province.

ANNUAL REPORT OF THE SENIOR ENTOMOLOGIST, 1948

Staff

Dr. R. Le Pelley was on duty throughout the year, but was away from the Colony for about four weeks in July and August attending the Commonwealth Mycological Conference, the Commonwealth Entomological Conference and the African Phyto-Sanitary Conference.

Mr. J. F. Graham, M.Sc., Entomologist, joined the section on 1st November, After a short while at the Scott Agricultural Laboratories he was posted to Kitale for work chiefly on chafer grub and maize stalk borer.

Mr. C. F. Fox, Senior Assistant Agricultural Officer, left the Colony on vacation leave on 6th June and was away until the end of the year.

Miss Jean Sergeant, Junior Laboratory Assistant, left the section on resignation on 1st March.

Mr. R. G. Smith rejoined the section as Junior Laboratory Assistant on 19th April, being occupied mainly on plant inspection and assisting in the work of the Plant Protection Ordinance. He was on duty till the end of the year.

Mr. I. R. Cormack joined as Junior Laboratory Assistant on 1st April, being occupied mainly on stored products work and on insect records, and was on duty till the end of the year.

Two African laboratory asistants were on duty throughout the year.

The Senior Entomologist attended the fifth Commonwealth Entomological Conference (22nd–30th July) as official delegate from Kenya and was a member of the special business committee appointed at the conference. He contributed to the discussions on biological control dealing with the biological control of the common mealy bug of Kenya and is on the committee set up by the conference to consider various aspects of the organization of biological control work in the British Commonwealth for submission to the next Commonwealth Agricultural Bureaux Review Conference to be held in 1950.

Plant Protection

During the year the Plant Protection (Fines) Rules, 1948, were made (G.N. 953 of 17th September, 1948). These rules laid down the fines to be imposed for disinfection or treatment considered necessary and carried out on any plant, seed or fruit imported into the Colony. It was found advisable to impose fines for any special inspection or treatment made necessary because of failure to comply with normal legal requirements since on average considerably more time was spent by inspectors in connexion with irregular importations than in those conforming in all respects to the requirements of the law. It was hoped that it might result in a decrease in infringements, but it is not yet clear that this is occurring.

The work of the Plant Protection Ordinance remained at a considerable volume during the year, 698 plant importation permits being issued. The bulk of plant material imported was inspected by the Chief Grader and Inspector at Mombasa, but a large number of parcels of plants and seeds received by post and air freight were inspected in Nairobi.

As a result of discussions with specialists of the Ministry of Agriculture and Fisheries and with the practical co-operation of that Ministry in inspecting plants it proved possible during the year to modify the complete ban on herbaceous ornamental plants. Permits are now issued for such plants (with a few exceptions) subject to certification that they have been satisfactorily inspected during active growth, with special reference to tomato spotted wilt. This at first applied

to plants from England, but similar arrangements were made in respect of Scotland before the end of the year. These arrangements allow for importation while offering a high degree of safety against introduction of the disease mentioned.

The following insects and diseases were amongst those intercepted on imported plant material. Most of these have not yet been identified:—

Aphid on *Acroceras macrum* grass from Southern Rhodesia.

Aphid on geranium foliage from Tanganyika Territory.

Aphid on bulbs from the United Kingdom.

Aphid
Thrips
Coreid nymph
} on lily of the valley flowers from England.

Septoria dianthi on carnations from England.

Calandra oryzae
Oryzaephilus surinamensis
Tribolium castaneum
Rhizopertha dominica
} *ex* various seeds from India.

The acknowledgments of this department are due to the postal and customs authorities for their helpful co-operation. I would like to acknowledge the help of my colleague the Chief Grader and Inspector in matters concerned with the importation of plants, particularly in connexion with the heavy work of inspecting plant imports at Mombasa.

The issue of plant export certificates numbered 93. It may be mentioned that all these certificates entail a meticulous examination of the plants inspected and that some of the certificates cover a large and varied assortment of plants. There is no doubt that the high standard demanded by the certificate and maintained here by inspectors has the result that in general the material submitted for certification is very clean.

In order to facilitate the export of plants to Tanganyika from all parts of Kenya, experiments in fumigation of plants with HCN in a fumigation chamber specially designed for this purpose were carried out. These experiments were uniformly successful, giving complete mortality of the coffee mealy bug (*Pseudococcus kenyae*) and the pine-apple mealy bug (*Pseudococcus brevipes*) at dosages which did not injure the plants. A report on these experiments was sent to the Department of Agriculture, Tanganyika Territory, and it is hoped that as a result plant importation permits will be issued for importation into Tanganyika of plants from Kenya.

Investigational and Advisory Work

One hundred and fifty-one items, either insect pests or infested plant material, were sent to the laboratory for examination and advice. Advisory visits were made to farms and plantations when possible, and a large number of visitors seeking advice on insect control visited the laboratories. Investigational and advisory visits were paid to the Teita hills where vegetable insects were studied and to Mwatati where pine-apple and sisal pests were studied. Advisory visits were also paid to other parts of the country.

Maize Stalk Borer.—There was a decrease in the severity of maize stalk borer attack this year, which in part can be attributed to the closed seasons maintained in recent years. Mr. Graham began an investigation of various aspects of the maize stalk borer problem after joining the section in November.

Chafer Grub.—This pest was not so much in evidence and the very severe damage that occurred during the war years was not maintained. Nevertheless, the chafer grub problem remains a most important one since the insect is always

a potential major pest. Control and bionomical investigations on the insect are continuing.

Prickly Pear.—Further trials were carried out during the year of spraying with D.N.O.C. (Dinitro-orthocresol) in diesel oil. These were made by agricultural officers in several districts. It is confirmed that spraying with this chemical fells the plant to the ground, but small centres of living tissue remain in the largely disintegrated pads and these form primordia for regrowth. This regrowth has been sprayed three times with the same result, further regrowth occurs each time. The method cannot therefore be considered satisfactory in its present form and further experiments with modified or different materials are planned.

New Insecticides.—Testing under local conditions of D.D.T., BHC Parathion, HETP and various proprietary insecticides has continued slowly as time and opportunity have permitted, but staff has not been available to deal adequately with this very important work.

Stored Products.—With the co-operation of the Chief Grader and Inspector and agricultural officers a survey of the stored products insects in foodstuffs was begun. As a result large numbers of stored products insects were obtained which have been indentified by the Commonwealth Institute of Entomology. It is proposed to continue this survey and publish the findings when more information has been accumulated.

Experiments on the protection of stored maize with insecticides were begun during the year and these first experiments will be concluded during 1949.

Army stores infested with various storage pests were examined and reported on and various emergency fumigations under tarpaulins were arranged and carried out on behalf of the Army by this section. Stocks of biltong were heavily infested with *Dermestes maculatus* and *Necrobia rufipes,* stocks of groundnuts with *Tenebrioides mauritanicus, Laemophloeus minutus* and *Oryzaephilus surinamensis, Tribolium castaneum* and an unidentified lepidopteron. The Army authorities were advised to construct a fumigation chamber for the early treatment of infested foodstuffs, whereby considerable losses would be avoidable.

Desert Locust

Early in the year Dr. R. Le Pelley was occupied in locust work in connexion with a conference of specialists from different countries arranged by the East African Anti-Locust Directorate which took place in February. At this conference recommendations were made for the formation of an organization to survey and control outbreak areas of the desert locust. The East African Anti-Locust Directorate was charged with the responsibility of following up the recommendations and it is pleasing to record that the Desert Locust Survey was set up as one of the High Commission services on 1st October, 1948. The East African Anti-Locust Directorate continued to function until 30th September, 1948, when it ceased to be active.

Miscellaneous Pests

Among the pests occurring during the year may be mentioned the following: a Buprestid borer in wattle trees at Eldoret which has not yet been identified; the sisal weevil (*Scyphophorus acupunctatus* Gyll) which continues to cause damage in the Teita and coast areas; red scale (*Aonidiella aurantii* Mask) on citrus trees from various parts of the country; Galerucid beetles (*Megalognatha* spp.) on wattle, loquats and other plants, particularly destroying flowers; a Buprestid borer (*Tragocephala variegata* Bert) in citrus from Mombasa; the Tenebrionid *Dacus simplex* F. damaging young maize; fruit fly *Dacus* sp. on marrow and cucumber; the bean fly *Agromyza phaseoli* Coq. on beans in Nairobi district; mites on citrus from Machakos; *Pseudococcus brevipes* Ckll. on pine-

apple in the Teita area; scale insects, particularly various species of *Saissetia* attacking several plants; the Coreid *Anoplocnemis* sp. attacking niger oil; army worm (*Laphygma exempta* Walk.), of which a fairly large and severe infestation developed in December covering large parts of the Masai, Nairobi and Machakos districts; sawfly (*Athalia* sp.) on turnips; diamond back moth (*Plutella maculipennis* Curt.) widespread on cabbages; the Noctuid *Polia inferior* Guen. attacking beans; the Halticid *Haltica pyritosa* Er. stripping the leaves of rhubarb in the Teita hills; a species of *Heteronychus* sp. damaging maize at Nyeri; various chafer grubs, including the common chafer grub *Schyzonycha* sp. of the Trans Nzoia, damaging maize and other plants; the stalk borer *Sesamia* sp. on maize at the coast; the Agromyzid *Epimadiza nigra* Mall. boring in the stems of gladiolus; the Pentatomid *Plataspis vermicellaris* St. damaging the bark of fig trees in Eldoret; the false codling moth *Argyroploce leucotreta* Meyr. from guava fruits in Nairobi district.

In conclusion I should like to acknowledge the invaluable help of the Commonwealth Institute of Entomology particularly in connexion with the identification of insects.

R. Le PELLEY,
Senior Entomologist.

ANNUAL REPORT OF THE SENIOR PLANT PATHOLOGIST, 1948

During the first seven weeks of the year Mr. R. W. Rayner, Plant Pathologist and Physiologist (Coffee), was acting Senior Plant Pathologist in addition to his other duties. I returned from leave on 19th February and this report covers the period from that date to the end of the year.

Wheat Stem Rust

Thirty-four samples of stem rust collected in the field and forwarded by the Senior Plant Breeder were tested for the determination of the physiologic form of rust present. In all, 47 tests on the differential wheat varieties were done. Of the forms already known Nos. K.1 and K.4 occurred most frequently. A number of the samples sent proved to be an apparently new form, bringing the total number up to eight. K.8 differs from the previously isolated forms in giving a susceptible reaction on Einkorn and the varieties 112 and 256. This rust has been multiplied up from a single pustule and added to the collection of physiologic forms maintained at the Scott Laboratories.

As in previous years a field epidemic was produced in the plant breeding cage surrounds for the purpose of subjecting new hybrid wheats to attack by all the known forms of stem rust occurring in the Colony.

A certain number of determinations were done on stem rust collected in Tanganyika.

Seed Testing

The seed testing laboratory and service continues as part of the pathological section. During the year 289 samples were received for analytical purity and germination tests. These consisted of samples of cereals, vegetable seeds, flower and grass seed, mainly Rhodes grass and *Bromus marginatus*. Tests on the viability of seeds from certain weeds treated with hormone weed killers were done for departmental officers. Preliminary tests with tetrazolium salts for the indication of seed viability were tried. A number of inquiries dealing with weeds and other wild plants was dealt with.

Blight Immune Potatoes

A further collection of eight varieties of blight immune potatoes was received from Dr. Black. These were grown for testing and multiplication at the Scott Laboratories. Previously introduced blight immune potatoes are now in commercial production by a number of farmers. Of the varieties tested during the year the most promising appear to be 914a(12) and 1427a(8). Small nucleus stocks of these two varieties have been obtained for multiplication at a higher altitude where there is less likelihood of virus infection.

A number of the earlier introduced varieties from Corstophine, Northern Ireland, and the United States of America has been maintained at the Scott Laboratories.

Plant Diseases

Increased settlement and the expansion of the department, particularly in the appointment of specialist crop officers, has resulted in a greater number of specimens and inquiries reaching the laboratory. During the ten months from 1st March until the end of the year 275 specimens of diseased plant material were received from officers of the department and private inquirers.

Field Crops

Potato.—Blight, *Phytophthora infestans*, was again widespread as in previous years since its appearance in 1941. The disease is now fairly well known and few samples were sent in for identification. Two samples only were received of the bacterial wilt *Xanthomonas solanacearum*. Both instances were of the strain previously described (*E.A.A.J.* XII. 1.30), which forms no discoloration of the vascular ring either in stem or tuber. *Solanum nigrum* proved by inoculation to be susceptible to this strain.

Pyrethrum.—The bud disease, *Ramularia bellunensis,* continued to be widespread but, with the exception of a few isolated attacks, not so serious as in the previous year. Outbreaks were recorded for the first time from the Nyeri–Nanyuki district. A particularly severe attack occurred over a considerable area on the North Kinangop.

Root and crown disease associated with *Fusarium* species and *Sclerotinia minor* occurred sporadically. A few examples of attack by the root knot eelworm were received.

Cereals.—Take-All of wheat, *Ophiobolus graminis* was of occasional occurrence on the Plateau. Advice on the preparation of inoculum and treatment of soil in an experiment to test the carry-over potentialities of *Bromus marginatus* in the rotation was given. This grass has not, so far, been proved to be susceptible to this disease. Trials to ascertain this are being carried out at the Scott Laboratories.

Stunted wheat plants affected with Take-All had a coralline root structure with numbers of small galls with inhabiting nematodes. The genus was not determined nor was further investigation possible. Possibly a species of *Anguillina* was involved. No instance of attack by *Heterodera marioni* on cereals has been recorded in Kenya. Wheat plants grown for rust work were severely attacked during the short rains by *Erysiphe graminis.* Other diseased material received was of *Helminthosporium* foot rot of wheat and barley seedlings, *Fusarium* root rot of mature wheat plants, covered smut of barley and stem rust of oats.

A disease of maize occurred in various localities west of the Rift Valley. The disease, which affected mature plants, caused a rot of the nodes and base of the cobs, in some instances preventing the latter from forming. In severe examples, the plants collapsed at an affected node. Although the affected tissue is soon invaded by *Fusarium* sp., as far as could be ascertained, the disease starts as a bacterial infection. Cultures were made of the organisms but it was not found possible to carry out inoculations. Most of the maize plants seen were exceptionally well grown specimens. The disease appears to start as a wet rot and may completely invade young soft cobs. The disease is distinct from Stewart's vascular disease of maize. Maize rust, *Puccinia maydis* was generally present throughout the maize-growing districts. Specimens of cob rot caused by *Fusarium graminearum* and *F. monileforme* were also received for identification.

Leguminous crops.—Peas grown for the seed trade were attacked by the powdery mildew, *Erysiphe polygoni* and leaf blotch, *Ascochyta pisi* in varying degree. The latter fungus occurred on samples of pea seed sent to the Seed Testing Laboratory. French beans were attacked by *Colletotrichum lindemuthianum* and halo blight, *Pseudomonas medicaginis* var. *phaseolicola* which organism or related species occurred on *Pueraria* sp. at Nairobi.

A plot of *Vigna sinensis* suffered from a severe attack of *Septoria vignæ* P. Henn, which caused "Chocolate Spot" and defoliation. *Ascochyta phaseolorum* Sacc. was also present on the same host. Leaf spot caused by *Isariopsis griseola* commonly occurred. Green gram, *Phaseolus aureus* in the Embu district was severely attacked by powdery mildew *Erysiphe* sp. Broad beans were received from Subukia with typical "Chocolate Spot" lesions from which *Botrytis cinerea* was isolated. Lentils, in an experimental plot, were attacked by powdery mildew, *Erysiphe polygoni. Septoria lablabina* was recorded on *Dolichos lablab.* Lucerne was received from a number of localities attacked by *Pseudopeziza medicaginis* and rust, *Uromyces striatus,* the latter frequently parasitized by *Darluca filum.* In the Nanyuki district, lucerne was severely attacked by the violet root rot fungus, *Helicobasidium purpureum.*

Flax.—One instance only was reported of the Pasmo disease, *Sphærella linorum.* The same disease was confirmed on material sent from Uganda. Other diseases noted were wilt, *Fusarium lini,* powdery mildew, *Oidium lini,* and rust. *Melampsora lini.*

Sunflower.—Sunflower, grown as a commercial crop, suffered from severe attacks of rust, *Puccinia helianthi.* In one instance, no distinct pustules were evident, the rust spreading in large patches over the leaves. Specimens were received from many districts of severe attacks of the white rust, *Cystopus tragopogonis.* A leaf spot caused by an *Ascochyta,* or possibly *Diplodina helianthi. Septoria helianthemi* and *Alternaria* (*zinniæ*) were also noted.

Herbage Grasses.—In addition to the commonly occurring *Sphacelia,* frequently accompanied by *Cerebella,* ergot sclerotia, *Claviceps* sp. were received on *Brachyaria* sp., *Andropogon* sp. and *Cynodon plectostachium.* Sclerotia on the last host occurred in profusion in two localities but had not previously been observed. *Fusarium* and *Epicoccum* spp. were present on the influorescences of a number of grass species.

Fruit.—Armillaria mellea caused the death of apple and plum trees in the Highlands. *Rossellinia necatrix* attacked apple trees and apricots. Conidiophores of this fungus were produced in the laboratory. Apple cracking and twig blisters associated with *Coniothecium chomatosporium* were investigated. Specimens of peach leaf curl, *Exoascus deformans* and rust on various stone fruits were received from a number of sources.

Diseases of passion fruit, *Passifloria edulis,* included "woodiness", *Septoria fructigena, Alternaria passiflorœ* and die-back of the droppers due to a strain of *Colletotrichum glœosporiodes.*

Specimens of a disease of wild and cultivated *Rubus* species were received from the Agricultural Officer (Horticulture). The symptoms of the disease were spur blight, canker and twig die-back. Few fruits reached maturity. On all the affected parts of the plants were spore masses of a species of *Glœosporium,* in such profusion as to produce a pink coloration of the fruit. Acervuli of the same fungus occurred on diseased spurs and on the twig and branch cankers.

A rot of pear fruits on the trees was caused by *Glœosporium fructigenum. Uncinula necator* caused injury to ripening grape fruits and a species of *Oospora* was the cause of an end rot of banana fruits growing at an altitude of 7,000 feet.

Strawberry plants were attacked by *Rosellinia necatrix,* causing a crown rot and death of the plants. The fungus had spread from nearby diseased apple roots. From strawberry plants showing a progressive decline were isolated *Trichoderma lignorum* and a species of *Phomopsis.* Leaf spot, *Mycosphœrella fragariæ* was generally present.

Vegetables.

Tomato.—Tomato blight, *Phytophthora infestans,* was severe and widespread, completely destroying the crop in many instances. The physiological blossom end rot was again prevalent and the subject of many inquiries. *Septoria lycopersici* caused little damage.

Other diseases of vegetables received were *Septoria lactucæ* on lettuce, *Alternaria porri* on onions, and *Alternaria brassicæ* on turnips. Asparagus was severely attacked by *Puccinia asparagi;* in one instance the rust was heavily parasitized by *Darluca filum.*

Ornamentals.

The following fungi were recorded on ornamental plants:—*Septoria dianthi, Uromyces caryophyllinus, Heterosporium echinulatum* and *Fusarium wilt* on carnations, *Alternaria zinniæ* on *Zinnia.* Dahlias were everywhere severely affected by *Entyloma dahliæ.* Leaf spots of *Gerbera jamesonii* were caused by the commonly occurring *Septoria gerberæ* and, to a lesser degree, by *Ascochyta gerberæ* and a species of *Cercospora. Cystopus cubicus* was of common occurrence on this host. Diseases of the rose included *Cercospora rosicola* and *Sphaceloma rosarum.*

Of miscellaneous diseases, safflower, *Carthamus tinctorius* was attacked by *Glœosporium* sp. causing the death of the apical four or five inches of the plants which were distorted and completely covered with pink spore masses. *Ustilago utriculosa* and *Melanopsichium* sp. occurred on *Polygonum*.

Forest Pathology

A disease of *Eucalyptus* species, causing splitting of the bark and exudation of gum, at ground level occurred in the vicinity of Nairobi and Thomson's Falls. Other manifestations of what is probably the same disease are a darkening and incrustation of the bark with copious gum flow and occasional large tumour-like swellings at various heights. The disease is possibly physiological.

Wattle (*Acacia mollinima*), west of the Rift Valley suffered from a progressive disease, resulting in the death of young trees over a wide area. The disease appears to be in, the early stages, a severe form of phloem necrosis. Later swelling and cracking of the bark and distortion of the stem near ground level develops. There is apparently no correlation between incidence of the disease and different soil types and no peripheral spread. The possibility of a virus disease is not overlooked but it has not been possible to study the disease.

Armillaria mellea was the cause of the death of *Cupressus macrocarpa* and *Pinus insignis* in the Mau forest area. *Phomopsis* and *Trichoderma* species were isolated from the bole of a dying *Pinus insignis* tree from the same area.

Monochætia unicornis canker of *Cupressus* continues to cause much concern and threatens the establishment of *C. macrocarpa* stands in the Mount Kenya district. During the year under review the disease has been confirmed on material west of the Rift Valley and the Aberdares. Further study has revealed the existence of strains of varying virulence which differ markedly in cultural characters and particularly in the capacity to sporulate on artificial media. Studies in susceptibility of species of *Cupressus* and other conifers are being pursued.

C. pyramidalis has been added to the list of susceptible species.

It is suspected that in addition to entry through wounds normally occurring on the trees, possibly the majority of infections take place at the crotch. Evidence is accumulating that this is so. In view of the minute fold in the bark at this point where spores would be inclined to lodge, it seems possible that a fungicidal dust applied from the air would here lodge also and possibly give considerable control of the disease. Further experiments on the mode of entry are in progress. In addition to the highly virulent form of the disease present in the main forest areas where the effect on young plantations is serious, there appears to be a mild form in the drier lower areas which occurs on the branches of large trees causing swelling and resin flow but otherwise causing little inconvenience to the tree. Inoculation work with isolations from this form are in progress.

An unidentified fungus in the *Phœophragmiæ* of the *Sphæriales* has been proved by cultural and inoculation work to be the perfect stage of *Monochætia unicornis*. The perithecia occur rarely but have been found connected with the mild form of the disease and with the highly virulent form. Attempts to induce the formation of perithecia by keeping cankered material exposed to natural conditions for some months have so far failed. Galls with which is associated *Ceratostoma juniperinum* occurred on *Juniperus procera* and similar galls with the same fungus on *Cupressus macrocarpa*. *Engleromyces Gœtzii* was received on bamboo.

I gratefully acknowledge the continuous help given to me in all aspects of the plantation work by Mr. W. H. Hewitt, Assistant Agricultural Officer at the Scott Laboratories.

R. M. NATTRASS,
Senior Plant Pathologist.

ANNUAL REPORT OF THE SENIOR SOIL CHEMIST, 1948

Staff

From 1st January, following the retirement of Mr. V. A. Beckley, latterly he Senior Agricultural Chemist, the Senior Soil Chemist has taken over this vork and has also been officer in charge of the Scott Agricultural Laboratories. The latter duties have involved a fair amount of administrative work.

There have been numerous staff changes during the year. From 1st January Miss E. C. Garrod, Junior Laboratory Assistant, and two African Laboratory Assistants of the Pyrethrum Section were transferred to similar duties with he Scientific Advisor to the Pyrethrum Board of Kenya. Mr. A. F. Ryan was ngaged as Junior Laboratory Assistant in the Pyrethrum Section from 1st April, 948. Mrs. E. Watkins, Junior Laboratory Assistant, also in the Pyrethrum ection, resigned at the end of November and was replaced by Mr. N. F. Cuthbert as Learner Laboratory Assistant. Mr. J. Hopkins, Agricultural Chemist (Pyrethrum) was on vacation leave from July. Mr. G. B. Rattray, Agricultural Officer, was seconded for laboratory duties from 19th February and on 24th February Mr. E. G. Ward was engaged as temporary Laboratory Assistant. The atter two have been mainly engaged in the Soil Section of the Laboratories. Mr. G. M. F. Grundy and Mr. B. R. Norman were on duty throughout the ear.

Mr. W. H. Hewitt, Assistant Agricultural Officer, remained in charge of ield work. There have been frequent and disturbing changes in the post of lerk in charge, who has charge of the stores and does accounting. Three different fficers have held this post during the year.

Analytical Work

The total number of samples dealt with in the chemical laboratories during he year amounted to 1,349, an increase of 148 over the previous year. Only 52 amples, comprising certain feeding stuffs for export and local use, fertilizers, yrethrum and water samples were subject to scheduled charges for analysis, the emainder being classified under free services to agriculturists and investigational vork.

Owing to a continued fall in the exports of baled pyrethrum there has een a marked decrease in the number of pyrethrum samples analysed from 39 to 209. Also, with the completion of laboratory work on the kiln-preparation f sodaphosphate, there has been a marked decrease in the number of fertilizers nalysed. However, in the case of all other classes of materials there has been n increase, this being more especially the case for samples analysed in con- exion with investigational work.

During the year a total of 693 soil samples has been dealt with, an increase f 230 over the previous year, due largely to a great increase in connexion vith the choice of potential tea soils. Last year it was reported that 33 such oil samples were submitted, whereas this year the corresponding number of amples reported upon amounted to 184. Most of the samples were received n large batches from new, experienced tea planters now investigating the ossibilities of planting tea in East Africa, mainly in the Nandi, Kaimosi, Kericho nd Sotik districts.

A total of 430 soil samples was examined and reported upon in connexion ith advisory services. It would save much correspondence and the Senior Soil hemist could be more helpful if more of those seeking advice supplied repre- ntative composite samples and gave more information about field conditions, ast crop performance and on the particular information that is required as numerous instances in the past the laboratory has received samples of soil ith no information other than the name and address of the sender. Whenever ossible farmers are encouraged to bring representative soil samples to the labora-

tories so that the necessary details can be obtained. In the case of many soils certain qualitative tests are sufficient and the farmer can be informed of the merits and needs of different soils. The number of soil samples analysed in connexion with investigational work amounted to 263.

Apart from the soil samples referred to above, 159 separate lots of treated soils have been used and as many lots of cereal seedlings analysed for their total phosphate contents in connexion with pot culture work on the "early availability" of different classes of phosphatic fertilizers when applied in different ways to different soil types.

In 1948 only 43 samples of fertilizers, composts and limestone and limestone products were analysed. The main comment is that estate-made compost and cattle manure collected from the plains contain excessive amounts of earth ranging from 60 per cent to 80 per cent of the total dry weight. Samples of dry seaweed examined have been exceptionally low in nutrients, containing only some 0.5 per cent potash and about 0.1 per cent of nitrogen and phosphoric oxide. Many samples contained 10 per cent to 15 per cent of common salt. The number of feeds and plant materials analysed, including 95 samples of tobacco leaf for nicotine content, was 172.

Some interesting data arising out of the analyses of feeds and plant materials may be quoted. A few analyses of everlasting pea hay (*Lathyrus latifolius*) cut when the crop was bulky contained as much as 27 per cent to 29 per cent crude protein, 3 per cent of oil with 25 per cent of crude fibre. Following these promising analyses a plot of this legume has been planted out for observations on the effect of cutting, yields and periodical analyses. With the increase in the growth of sunflowers different parts of the plant have been analysed. Dried leaf taken when the plant was in full flower contained about 20 per cent crude protein, 3.5 per cent oil, 50 per cent crude fibre and a high total ash content of some 14 per cent. Rhodes grass hay contained 16 per cent to 18 per cent crude protein.

A summary of the different classes of samples analysed, including those used in investigational work, is as follows:—

Soils	693
Pyrethrum	209
Feeds and plant materials	172
Pot culture seedlings	159
Fertilizers	43
Waters	16
Miscellaneous	57
	1,349

The total number of people who called on the Senior Soil Chemist during the year, including those bringing samples for analysis, amounted to some 700. These interviews take up a fair proportion of time, but information is received as well as given and the amount of necessary correspondence is reduced.

Investigational Work

The main item of the investigational work has been a continuation of pot culture work on the relative availability of different classes of phosphatic ferti lizers when added in different ways to different soil types. This has special reference to the manurial value of local products, such as Uganda rock phosphate and sodaphosphate, prepared from it. Work on soil classification and nomenclature has been mainly the sorting out of a vast amount of field notes so as to evolve some suitable system of classifying several hundred combinations of

natural soil conditions that have been recorded in the past. Small trials have been continued with selective weedicides and a little work has been done on the development of new fibre plants. An investigation on the deterioration of baled pyrethrum was completed and some work done on the use of anti-oxidants as preservatives.

The Development of Local Sources of Phosphatic Fertilizers.

One factor that will undoubtedly play an important role in the proper future development of farming is the provision of adequate and suitable supplies of cheap phosphatic fertilizers. Further work has been done on the relative availability of Uganda rock phosphate and sodaphosphate prepared by calcining the former with Magadi soda. Extensive field experiments are being undertaken by others, and the Senior Soil Chemist has continued with parallel pot culture trials, for which work there are suitable facilities at the laboratories.

In the study of the "early availability" of low- and high-grade sodaphosphate, as compared with superphosphate, using wheat on the Thomson's loam, there was a recovery of 13.4 per cent from low-grade sodaphosphate with 13.9 per cent of "citric-soluble" P_2O_5; 23.6 per cent from high-grade sodaphosphate with 22 per cent of "citric-soluble" P_2O_5 as compared with 22 per cent from superphosphate. This and other trials have shown that the root soluble or "early availability" of sodaphosphate is about proportionate to the amount of contained phosphate that is soluble in citric acid. The pot culture trial also showed that high-grade sodaphosphate was about equally available as superphosphate with this particular soil.

A trial was arranged to find out the relative early intake of phosphate when sodaphosphate and triple-supers were dressed on to the seed, as compared with placement in the soil, using wheat grown in the Kikuyu red loam. The dressing of the seed was done by wetting with a solution of casein glue and then after an interval dusting and mixing with weighed amounts of finely ground fertilizers. As dressed seeds retained some of the added phosphate it was necessary to discard the remaining seed portion and to analyse the shoots and roots only. There was poor germination when triple-supers was dressed on to the seed and also a slight detrimental effect when sodaphosphate was so placed, but the data obtained is sufficiently accurate to show that "water-insoluble" sodaphosphate is more available when placed in the soil than on the seed, whereas the intake from triple-supers was about three times as great following the dressing of the seed as compared to its placement. In a subsequent trial it was found that lower germination following dressing with triple-supers could be avoided by previously neutralizing the fertilizer with lime, but the resultant reduced solubility of the material resulted in the P_2O_5 intake being about halved.

A further trial was made to test the dressing of sodaphosphate at the two levels of 0.10 and 0.15 mg. P_2O_5 per 100 seeds weighing 4.7 gm. as compared with placement in the soil. Following the dressing of the seed the recovery of P_2O_5 was 9.1 per cent and 8.7 per cent, whereas the placement of the same quantities of sodaphosphate gave recoveries of 17.2 per cent and 17.6 per cent. This trial confirmed that sodaphosphate, which is water-insoluble, is much more "early available" when placed in the soil than when concentrated around the seed. A similar trial with Seychelles phosphate confirmed that, as expected, the intake is very much lower when dressed on to the seed than when placed in the soil.

The relative recovery of phosphoric oxide from high-grade sodaphosphate as compared with that applied in the form of triple-superphosphate, based on a similar total P_2O_5 content, for five different main soil types is given by the following values of percentage recoveries:—

Soil Type	*1*	*2*	*3*	*4*	*5*
Triple superphosphate	22·6	13·4	23·2	21·0	22·0
Sodaphosphate	21·4	18·1	20·4	24.5	23·6

Sodaphosphate used with the first three soils contained 21.3 per cent of "citric-soluble" P_2O_5 and that with the last two soils had 24.5 per cent. These trials with five soils showed that the root-solubility of high-grade sodaphosphate, as measured by the phosphate intake by cereal seedlings over two weeks of growth, was at least as much as for triple-superphosphate.

Another trial was arranged to note the effects of the degree of granulation of triple-supers on phosphate intake by cereal seedlings. Even over two weeks of growth only there was only a slightly smaller intake with increasing coarseness ranging from material passing the 100-mesh sieve (0.15 mm.) to that passing a 2 mm. but held on a 1 mm. sieve. The recovery values in order from fine to coarse were 10.7 per cent, 10.2 per cent, 9.8 per cent and 8 per cent.

The effect of the granulation of triple-superphosphate on P_2O_5 intake by a sequence of seedlings covering 100 days was estimated in a further trial. Triple-superphosphate of varying grades of fineness was mixed with triplicate lots of soil within soil zones of half an inch to two inches overlying two inches of untreated soil. The grades of fineness used ranged from the coarsest of 3 mm. to 2 mm. to "less than 0.15 mm.", thus giving about the following numbers of separate particles per c.c. of treated soil: 0.16, 0.8, 8, 68 and "over a million". Four successive lots of cereal seedlings were grown in the undisturbed soil and the shoots cut and analysed to show the relative phosphate intake resulting from applying equal amounts of triple-supers of varying degrees of fineness.

The content of P_2O_5, in order from coarse to fine, in the series of seedlings grown, based on 100 for shoots grown in untreated soil, was as follows:—

Period of growth in days	Seedlings grown	Particle size of triple-superphosphate				
		3–2 mm.	2–1 mm.	1–0·4 mm.	0·4–0·15 mm.	less than 0·15 mm.
0–18	Wheat	103	112	151	143	132
18–37	Rye	156	256	206	216	211
61–79	Wheat	156	168	162	147	149
82–100	Wheat	130	144	148	129	120
Mean for 4 lots		136	170	167	159	153

With the first wheat seedlings, material coarser than about 1 mm. was less available. It will be noted that rye is always more efficient in taking in added phosphates and the values given are only relative and cannot be compared with those for earlier or later wheat seedlings. The intake was good for all fractions and highest for the 2 mm. to 1 mm. fraction. In the case of the third crop of wheat seedlings grown during the period 61–79 days and the final crop of wheat up to 100 days the soil treated with the 2 mm. to 0.4 mm. fractions of triple-superphosphates gave the highest intakes. Over a period of 100 days since the addition of this fertilizer and covering 56 days of active phosphate intake by roots the recoveries increased slightly with increasing coarseness of particle size up to a diameter of 2 mm., but was least with still coarser particles of 2 mm. to 3 mm., of which there would be only one particle in some 6 c.c. of soil.

The amount of P_2O_5 removed in the four lots of cut shoots amounted to a maximum of about 40 mg. out of a total of 200 mg. of total P_2O_5 added to each of the 15 containers. This trial illustrates the usefulness of this pot-culture technique in studying differences in early phosphate intake resulting from minor differences in the manner of application.

A paper dealing with this pot-culture technique of studying the relative availability of different classes of phosphatic fertilizers was presented at the Conference Africane des Sols held in the Belgian Congo in November.

There is not sufficient evidence at present to warrant the use of Uganda rock phosphate by itself for annual crops. There is need to supply more readily available phosphatic fertilizers. Though under conditions of pot culture when the root solubility, or intake of phosphates by seedlings, is about as good for sodaphosphate as for triple-supers, statistical field experiments with cereals measured in terms of the yield of grain have shown a greater response to the superphosphate class of fertilizer. Further work is needed on the most suitable method of placing the two fertilizers and on their residual manurial values.

Weedicides.

The bulk supplies of selective weedicides received were dispatched up-country for large-scale trials by agricultural officers and only small-scale trials have been continued at the laboratories and in the vicinity. Such trials were carried out with Agroxone dust and spray and Chloroxone dust, using 1 lb., 2 lb. and 4 lb. of the active agent per acre. At no time in any of the trials were the *Gramineæ* affected by any of the treatments used. In general Chloroxone (2-4-D) at 1 lb. and Agroxone (MCPA) at 2 lb. of active agent per acre applied as dusts had no permanent effect. Chloroxone at two pounds destroyed *Amaranthus* spp. (pigweed), *Tagetes* spp. (Mexican marigold) and *Bidens pilosa* spp. (blackjack). Agroxone applied as a spray at 1 lb. per acre destroyed these weeds together with *Asystaria schimperi*. It was necessary to use 4 lb. per acre of the two materials applied as dusts to destroy most of the weeds. When Agroxone was applied as a spray half the quantity of active agent per acre gave similar results. In a series of trials with sodom apple, using Agroxone as dust and spray at 2 lb. per acre, and Fernoxone (2-4-D) used as a spray at 2 lb. per acre, all treatments resulted in the drooping and withering of the leaves, but the stems and roots remained healthy and the plants recovered. These and the previous year's trials have shown that under local conditions dusts are less effective than sprays with a large number of weeds. It is necessary to give 3 lb. to 4 lb. of active agent applied as dust to destroy most weeds, whereas 2 lb. applied as a spray is about as effective. Furthermore, there is some evidence that the 2-4-D type is more effective than the MCPA type for most weeds. There is now sufficient evidence to shown that future trials should be confined to sprays only, more especially with preparations based on 2-4-D.

Soil Classification and Nomenclature.

During the year further field work was limited. In response to a request to prepare a paper on the Classification and Nomenclature of Colonial Soils for the Conference on Tropical and Sub-tropical Soils held in the United Kingdom in June the opportunity was taken to draw up a tentative system of soil classification.

The term "classification" when applied to natural soils has a special meaning in that the range of soil conditions obtaining forms a continuous variant and therefore any division into classes must be arbitrary and not based on recorded exact characteristics. Furthermore, in deciding on soil nomenclature there are no "ideal" soils that are perfect representatives of named types of soil within different categories of classification. Soil classification, nomenclature and mapping have to be approximate, defining a described range of conditions. In the working out of a systematic method of classifying soils within the different categories and the generic relation of the one to the other there is need to accumulate a vast amount of descriptive and quantitative data for representative soil conditions found in different regions.

There is need for a higher category of classification than the soil series to group together associations of similar soil series within their great soil group. It is suggested that the term "Fasc", first proposed by G. Milne in 1935, be adopted as this terms conveys the parallel trend of the development of the component soil series. In East Africa there is need to allow for many more

new great soil groups than are recorded for other tropical regions. A great mass of soil data dealing mainly with the morphology of the soil profile has been gradually sorted out over the years and now a first attempt has been made to classify local soils. This work is not based on any organized pedalogical soil survey, but is a by-product of other kinds of field work. About 100 different combinations of natural soil conditions which had previously been recorded have now been classified and described, giving 70 named soil series and 30 named soil fascs. The basis of classification and the range of differing soil conditions that are permitted within the soil series and fascs have necessarily varied according to the different generic factors involved and the number of soil series within the suggested higher unit also varies.

In the case of zonal soils the nature of the weathering processes has been taken as the dominant factor in soil clasification. However, much of the land surface and the greater proportion of the soil series recorded cannot be grouped together on the basis of a characteristic weathering and well-defined soil profiles. Many soil conditions are the result of a combination of several soil factors and it becomes necessary in classifying these soils to decide which one factor plays the dominant role in characterizing groups of similar soil series. Thus, soils which do not reflect the influence of known soil-forming processes have been classified and grouped together according to what is judged to be the most dominant soil factor in each case. A special provision has been suggested for the clasification of truncated soils. Some examples of catenary complexes or soil catena have been described.

An account of the suggested system of classifying local soils with special reference to the planning of future work was presented at the Conference Africaine des Sols held in the Belgian Congo in November.

Other Investigational Work.

Seeds of plants yielding jute-like fibres were obtained from different sources and distributed to agricultural officers. The most promising plant has been *Urena lobata* which has done well at Taveta and at the coast. At Kibarani the crop yielded about 680 lb. per acre of good, up to 5 ft. long, retted fibre in three and a half months, and under irrigation at Taveta a good yield was obtained within three months. At the Scott Agricultural Laboratories growth was slow and stunted. This crop makes the best growth under moist, warm conditions. It was found that successful retting was possible in sea water. Further seed was bulked at the Scott Agricultural Laboratories and distributed. This fairly fresh seed had a very low germination of about 5 per cent only, but it was found that it could be increased about ten-fold by immersing the seed in boiling water until cool and then air-drying. This treatment was much more effective and convenient than the use of sulphuric acid.

Certain long-term co-operative work with the Senior Agricultural Officer, Kitale, was started on the formation of crumb structure under six different grass covers. It is intended that quadruplicate soil samples taken once per annum from the six plots be examined for the comparative development of crumb structure. The initial wet-sieving treatment of the 24 soil samples has demonstrated the difficulties involved in this type of work. Even in the case of an apparently uniform soil analyses have shown that there are appreciable local differences in the degree of soil aggregation, even for the four subsamples taken nine yards apart from each of the six experimental plots. A part of the differences obtained will be due to the necessary experimental error in the wet-sieving determination, but the differences for separate soil samples are much larger than for the replicate analyses of the same sample. The initial variation in soil aggregation throughout the experimental area, as shown by the proportion of true soil crumbs held on the 0.5 mm. sieve, i.e. after deducting contained sand, ranged from 28 per cent to 42 per cent, the individual samples showing marked variations. Furthermore, different soil samples had different

types of distribution curves for aggregates and it was found more correct to use calculated single values based on the proportion of four soil fractions and not on a single arbitrary fraction. The relative value, based on the summation of the product of the percentage of each of the four fractions present—after allowing for contained sand—and the inverse of the calculated surface area of the determined fractions, with a lower limit of 100 I.M.M., gave a better indication of soil aggregation. The actual soil differences that obtain for these plots are also reflected in the total nitrogen content of seven of the surface samples taken throughout the experimental site. The values ranged from 0.136 per cent nitrogen to 0.173 per cent nitrogen. In all field work dealing with the effects of treatments on soil aggregation much replication is necessary and there is need for caution in drawing conclusions based on laboratory work.

The carbon-nitrogen ratio was determined for a few soil types, the carbon being estimated by the sulphurdioxide method. For the coastal sandy soils with less than 0.1 per cent of total nitrogen there was a narrow C/N ratio of about 10. In the case of arable soils in the highlands, with 0.13 per cent to 0.17 per cent nitrogen, the ratio varied between 11 and 14 and for a fertile soil with the total soil nitrogen raised to 0.24 per cent to 0.26 per cent by the prolonged growth of a leguminous cover crop the ratio was 12.

Report of Mr. J. Hopkins, Agricultural Chemist (Pyrethrum)

The total number of samples analysed during the year is as follows:—

Trade export samples	72
Local sale samples	35
Investigational	102
Total ..	209

These figures show a considerable decrease over the totals for the previous year, particularly in regard to trade export samples. Owing to the expiry of the Ministry of Supply contract at the end of 1947 growing was considerably restricted during that year and the repercussions of this policy are evident in the reduced quantity of flowers exported during 1948. The heavy infestation of *Ramularia* in many areas also had its effect and reduced the quantity of flowers available.

The introduction of a new sales policy with regard to the East African Extract Corporation necessitated a new sampling procedure. Bulk samples of material supplied to the extract plant are sent to the laboratories where grinding and quartering are carried out, four identical laboratory samples being produced and distributed, one for immediate analysis in the laboratory upon which an official sale certificate is issued, one for analysis in the laboratory of the Pyrethrum Board, one for analysis by the East African Extract Corporation, and the fourth being retained for analysis by an independent authority should there be any disagreement between buyer and seller.

At the beginning of the year the laboratory equipped by the Pyrethrum Board and under its Scientific Adviser commenced operation and took over all breeding samples from the Plant Breeding Stations at Molo, Njoro and Ol Joro Orok.

A great deal of investigational work was continued during the earlier part of the year. A long-term experiment on deterioration of baled flowers during prolonged storage, originally laid down in 1947, was completed, and it is hoped to compile a paper on the results shortly. The use of anti-oxidants as a preservative for pyrethrum flowers was also further investigated with some encouraging

results, but further work is required before any conclusive statements can be made. In the July, 1948, issue of the *East African Agricultural Journal,* in connexion with this work, a paper entitled "A Note on the Deterioration of the Toxic Content of Separated Pyrethrum Achenes Compared with that of Whole Flowers" was published.

Much time was devoted to the investigation of solvents as a result of a new publication of the Seil Method of Analysis late in 1947. This method specifies the use of a petroleum ether boiling at 20° to 40° C. at the altitude where it is used. Such a low-boiling solvent being unobtainable locally attempts were made to produce it by fractionation from commercial petroleum products. It was found, however, that the use of a very low-boiling solvent gave unsatisfactory results and after many series of comparative analyses it was decided to return to the use of higher boiling petroleum ether in the range 50° to 80° C.

During June and July an elaborate collaborative scheme of investigation of three methods, the Mercury Reduction Method of Wilcoxon-Holladay, the Seil Method and the Ripert Method, was carried out under the direction of the Plant and Animals Products Department of the Imperial Institute. It is hoped that the result of this will be general agreement throughout the world on a standard method of analysis to be adopted by all producers and processors of pyrethrum.

With the departure on overseas leave of the Agricultural Chemist (Pyrethrum) in August further investigational work had to be discontinued.

Report of Mr. W. H. Hewitt, Assistant Agricultural Officer in Charge of Field Work

The total rainfall of 38.81 inches for the year was normal. The long rains of some 15 inches were good. The short rains were also good but delayed, there being a rainfall of nearly 15 inches within the last three months of the year. The long dry period between the rains was alleviated by a heavy fall of 3.16 inches in early August.

Herbs, Spices and Vegetable Crops.

Fennel and dill started well but yellowed and failed to set seed as did carraway. Sorrel grew prolifically but so far has not seeded. A small block of rhubarb grown under nursery conditions and well manured twice with *boma* manure produced a yield at the rate of about 24 tons per acre. Paprika, i.e. a sweet capsicum similar in shape to *C. frutescens* but not hot, is being grown for seed and a certain amount has been distributed.

The heaviest yields of tomatoes were obtained from plants that were not staked but supported by small frames when the plants were young. As they grew they lent over the frames which kept the earlier trusses raised from the ground, thus making them less susceptible to attacks by various insects. This was especially the case when the land had been mulched as this soil treatment harboured many harmful insects. Spraying with Burgundy Mixture at about eight-day intervals and certainly at not more than ten-day intervals during the whole of the wet season was found necessary as a protection against *Phytophthera infestans.* The mixture was used at 4 lb. copper sulphate and 2½ lb. of Magadi soda ash per 50 gallons of water. Unstaked and unpruned plants gave good yields, but with such plants it was necessary to ensure that spraying was thorough and covered the underside of the stems and leaves. Loss due to sunscorch was less under shade. A further trial using various methods of staking is being undertaken.

Grains and Feeds.

Hybrid Corn.—Five varieties of hybrid corn from the United States of America and one from Southern Rhodesia were tried out, together with two

plots of local Muratha maize. One American variety ripened within four months, but was so small that it was practically worthless, the average height of the plants being only 3½ ft. and the average weight of grain per cob being under ¼ oz. None of the other hybrids was as good as local Muratha maize. It is believed that it is unlikely that hybrid corn can be grown satisfactorily outside the country of origin and it would appear better to discontinue importing varieties from other countries and that there is need to wait until such time as it is possible to start breeding locally.

Muratha Maize.—This is being improved by planting only from specially selected cobs and given reasonable rains there should be some seed for distribution by the end of 1949.

Popcorn.—Three varieties of imported seed were tried out but were unsuccessful.

Wheat was grown in cages for rust testing by the Senior Plant Pathologist and several multiplication plots were successfully harvested.

Sorghum.—A further three acres were planted out with variety R.2.S.42. The crop ripened in the wet season and was badly attacked by birds. The yield was poor, being only slightly over three bags per acre.

Kudzu (*Pueraria phaseoloides*).—A small quantity of this seed was obtained from New South Wales. Germination was poor and growth was slow, but it appears to be more satisfactory than *P. thumbergiana* which has made exceedingly poor growth. On the other hand, some farmers report successful crops of the latter in the Thomson's Falls district. *P. phaseoloides* is also being tried out in other areas.

Potatoes.—Several blight-resistant varieties from the United Kingdom and America have been grown for the Senior Plant Pathologist.

Beans.—In trials with various beans from Kenya, Tanganyika and Uganda Plentiful was outstanding as an earlier and heavier yielder. An unnamed cream-coloured variety from Tanganyika was also good and is being multiplied with a view to distribution. Granada also did extremely well. A small quantity of imported Richmond Wonder beans did not do well, but a small quantity of seed has been saved and will be tried out again. Abundance, a small variety ex Uganda, was very late maturing but had a good spread and appears to be suitable as a cover crop or green manure. Imported Poona pea has so far been unsuccessful. Though it had an almost continuous flowering for nearly two months it set very little seed. It was badly affected by *Septoria* fungus and was attacked by cabbage aphis unless continually sprayed or dusted with D.D.T.

Sunflowers.—Three dwarfed types of imported seed (Mars, Jupiter and Pole Star) were planted in one of the wheat cages so as to obtain protection from birds. Although listed as dwarfs the first two attained a height of 6½ ft. and had to be cut before they reached maturity as the cage was being damaged. Mars appeared to have the sturdiest growth but Pole Star was the first to flower. All were affected by a fungus which discoloured the leaves, but this did not seem to affect growth.

Grass.—Some four and a half acres of poor land was put down to Rhodes grass, *Chloris gayana* (Trans Nzoia strain), in 1946 and 1947. Fifty-two bags of seed harvested in 1948 have been bulked for distribution. The seed had an average germination of 74 per cent.

Fibres.

Crotalaria juncea.—Over two acres of sunn hemp were planted with special seed obtained from Southern Rhodesia. This grew well and stood up to dry conditions. Owing to uneven ripening and lack of suitable machinery for harvesting and threshing there was considerable loss of seed, but a total yield of about 180 lb. per acre was obtained.

Urena lobata did not do well at the laboratories, though it produced plenty of seed. The seed, which is of the burr type, drops readily and there is the danger of it spreading as a weed. Twenty-two pounds, equivalent to a yield of some half a ton per acre, were distributed. Growth was short and dwarfed and it took six months to attain a height of 2 ft. while older, mature plants were only about 5 ft. tall.

Various.

Pyrethrum.—A small area was planted for use by the Pyrethrum Services. This was badly attacked by thrips, but spraying with 0.1 per cent D.D.T. wettable powder resulted in complete control.

Tobacco (*Nicotiana rustica*).—The progeny of a parent plant which had yielded 13 per cent nicotine gave much lower values; leaf from the best plants gave 8 per cent, while the majority of 60 plants analysed gave only about 5 per cent nicotine.

Passion Fruit (*Passiflora edulis*).—Half an acre planted in 1946 for investigational work on "Woodiness Disease" has been maintained. The first sign of this disease was noticed in a few plants in August, 1948, but up to the end of the year it showed no further spreading.

Coffee.—Seed has been harvested from the recognized best types of coffee and routine pruning, spraying and dusting has been carried out. Various blocks of coffee are being maintained for investigational work by the Agricultural Chemist and Plant Physiologist (Coffee Services).

Geraniums.—A fair demand for cuttings of *P. graveolens* continues and several new farmers are interested in this essential oil crop.

Peppermint.—This was badly affected by rust and completely died out in the dry weather.

Jojoba Oil (*Simmondsia californica*).—Seed of jojoba was obtained and young plants are now established but growth is extremely slow, being only about nine inches in the first year of growth.

Cupressus macrocarpa and *C. lusitanica.*—An area of about five-eighths of an acre has been planted with these trees for the purpose of research on *Monochætia* by the Senior Plant Pathologist.

Camomile (*Anthemis nobilis*).—Two roots of a hybrid from Thomson's Falls spread rapidly under nursery conditions and though growing well in the open during the wet season the plants died in the dry weather. With very few exceptions most of the plants failed to flower. A small quantity of roots imported from France are being grown in the nursery, but growth so far has been very slow and it will be some considerable time before any roots of this material will be available for distribution.

Bananas.—At the request of Professor Baker 11 special varieties of Kenya bananas have been planted and are doing well.

General

During the year the Senior Soil Chemist attended the Specialists' Conference on Tropical and Sub-tropical Soils held in the United Kingdom in June and the Conference Africaine des Sols in the Belgian Congo in November. Four papers dealing with original work were presented at these conferences. In the case of two papers much laboratory work was done by members of the chemical section and their assistance is gratefully acknowledged.

G. H. GETHIN JONES,
Senior Soil Chemist.

ANNUAL REPORT OF THE SENIOR PLANT BREEDER, 1948

Staff

Mr. H. C. Thorpe, Senior Plant Breeder, was on duty throughout the year.

Mr. A. Bolton, Plant Breeder, arrived from the United Kingdom on 21st July, on first appointment, and was on duty for the remainder of the year.

Mr. M. R. White, Learner Laboratory Assistant, arrived on first appointment on 3rd January, and was on duty for the remainder of the year.

Mr. H. Moraes, Goan Clerk, was transferred to the office of the Senior Agricultural Officer, Rift Valley Province, Nakuru, on 6th March.

Mr. A. W. Midega, African Clerk, was on duty throughout the year.

Visitors

Visitors from overseas during the season included:—

Mons. G. Tondeur, Director of Mission Anti-erosive and Dr. Guyaux, Provincial Veterinary Officer, Costermansville, Belgian Congo.

Mr. N. A. Duckham, C.M.G., Agricultural Attaché at the British Embassy, Washington.

Professor R. E. D. Baker and Mr. Simmonds, Imperial College of Tropical Agriculture, Trinidad, British West Indies.

Professor Cerighelli, Professor of Tropical Agronomy, France, and Mons. Cours, Chief of the Division of Agronomical Research, Madagascar.

Farmers' Days and Lectures

Farmers days were held at the Plant Breeding Station, 7,100 ft., and on the sub-station at Rongai, 6,000 ft., where the work in progress was explained.

Talks on the work of the Plant Breeding Station were given to students on the long and short courses at the Egerton School of Agriculture and parties of students were subsequently conducted round the station.

Publications

"Breeding Better Pyrethrum" was published by the *Pyrethrum Post* and issued in booklet form by the Pyrethrum Board of Kenya.

An article on "Suggestions for Wheat Varieties to Grow in 1948" was published in the local press.

The Wheat Season—General

In the Colony the season started off well with good rains in March and April. A dry spell of three weeks together with a low total rainfall and poor distribution (23 days with less than 0.1 in. at the Plant Breeding Station) was experienced in May which gave rise to some anxiety. June rainfall was considerably above the average and this was followed by sufficient, but not excessive, falls in July and August continuing into an above average September to ensure a heavy wheat crop of over one million bags, a record in the agricultural history of Kenya.

Figures of rainfall (inches) recorded on this station were:—

Month	*1948*	*Average (19 years)*
January	0.05	0.86
February	0.26	1.30
March	2.17	2.78
April	4.11	4.33
May	2.51	4.19
June	6.33	3.78
July	4.09	4.95
August	5.58	4.96
September	3.54	2.26
October	1.27	1.78
November	0.92	2.60
December	2.26	1.77
Totals	33.09	35.56

Rust and Other Diseases.

Considerably more black stem rust, *Puccinia graminis Tritici,* than in recent years was observed during visits to the wheat growing areas. This may be due to the hotter conditions associated with the lesser rainfall. Varieties susceptible to the disease were in all cases attacked and some crops of Reward and N.B. 230 on the Uasin Gishu plateau were completely destroyed. Sabanero and Equator were more rusted than usual.

On the other hand varieties bred and advised by us to be rust resistant were found to be free of the disease thus adding weight to the advice given every year to growers to sow only rust resistant wheats.

A survey of stem rust forms occurring in the Colony during the season showed K.1 and K.2 to be the chief forms in the higher areas with K.4 in the Plateau. This is probably due to the prevalence of Equator over 8,000 ft. susceptible to both K.1 and K.2, and to the growing of Equator, N.B. 230 and Reward in the Plateau, all susceptible to K.4. Growers have been warned that by continuing to sow susceptible wheats they run the very definite risk of lowered yields or even total loss of crop.

Leaf rust, *Puccinia triticina,* and glume blotch, *Septoria nodorum,* were little in evidence due to the drier conditions.

The Appearance of an Eighth Physiologic Form of Black Stem Rust.—During the season a new wheat variety 261.S.10.C.2.D, which had proved itself resistant to the seven physiologic forms of black stem rust isolated in Kenya up to this time, was observed to be attacked by rust at Oldeani and Ngare Nairobi in Northern Province, Tanganyika.

This rust has proved to be yet another physiologic form with susceptible reactions on the wheat testers 112.A, Einkorn and B.256.G. It has been called K.8. Subsequently K.8 was isolated in the breeding cages at the Scott Agricultural Laboratories. It has not yet been found in the field in Kenya.

The occurrence of a new rust form necessitates a re-examination of the breeding programme and the discarding of all crosses in which both parents show susceptibility to it. Established wheat varieties must also be tested and growers warned of those found susceptible. This may entail anything from a negligible or slight adjustment of the programme and the discarding of a small amount of susceptible material to a complete revision of the breeding work involving the abandonment of large quantities of fixed hybrids and wheats undergoing multiplication for large-scale field tests—a serious loss of time and work.

Accordingly, K.8 has been increased by the Senior Plant Pathologist and tests on a number of wheats for reaction to K.8 have already been carried out. Results so far completed show the following reactions in seedling tests:—

Resistant:—Kenya Governor, 291.J.1.I.1, 318.AJ.4.A.1, 318.O.3.B.2 and 261.R.7.C.1.B.

Bordering on Susceptibility:—Equator, 117.A and 294.M.7.C.6.A.

Susceptible:—Sabanero and Regent 975.6.

It is, of course, not yet known what effect K.8 will have in the field on susceptible varieties. An article has already been published in the local press warning growers of the presence of this new rust form and listing varietal reactions in so far as they are at present known.

Main Varieties Grown.

Once again 117.A and Sabanero formed the main varieties grown in the middle and lower wheat areas with Equator II in the higher areas. These three wheats have served Kenya well for many years and there is still no satisfactory substitute for Equator over 8,500 ft. All are of poor baking quality and too much, especially Equator, is not liked by the mills. The recently released selection Equator II continued to yield well and it is expected that it will increasingly replace the old mixed Equator I.

The season suited 291.J.1.I.1 which, although susceptible to leaf rust, was not appreciably attacked due to the dry conditions. This variety is of poor baking quality and is not liked by the mills: it is intended as a stopgap until better varieties are produced to replace it.

Regent, a hard red Canadian spring wheat released to farmers in 1946, continued to increase in popularity and is a valuable addition to Kenya wheats due to its good straw, yielding abilities and quality. The grain is popular with the mills. Regent is known to be susceptible to K.6, K.7 and the new form K.8 in seedling tests although it has not yet been reported as damaged in the field. A slight rust attack on this variety was seen on a visit to the Aberdares district at 8,500 feet. A test of the form proved inconclusive but suggested K.8.

294.M.7.C.6.A, described in the Annual Report of the Senior Plant Breeder for 1947 and released to farmers in that year, maintained its original promise and good yields were reported from the Plateau, Londiani, Njoro and Solai areas. This variety represents a substantial advance over 291 both in quality and in the range of altitude over which it can be grown. It also shows resistance to leaf rust and thus marks a notable advance in wheat breeding in Kenya. Ample seed supplies are now available to meet the Colony's requirements. Unfortunately 294.M shows a borderline reaction in seedling tests to K.8 and it is not yet known what effect this new rust form will have on the wheat in the field.

294.B.2.A.3 is a quicker maturing selection from the same cross as 294.M maturing about three weeks earlier. This variety was also released in 1947, has good straw and is of moderate quality. It is resistant to the first seven forms of black stem rust and it is being tested for its reactions to K.8. It is suited to the 5,000–8,000 ft. range in Kenya and is of use where a quick variety is required, such as for Nairobi conditions and the wheat areas of Northern Province, Tanganyika, or for late sowing in the longer season districts.

Other wheats which, although not rust-resistant, are still grown to a limited extent in certain districts include Kenya Governor, Burbank, Reward, N.B.230, 1066 and K.T.I.

Releases of New Wheats

Four new wheats were released to farmers from departmental control for sowing in 1949. The following description of these varieties was published in the local press:—

Wheat No. 318.AJ.4.A.1.—A selection out of the cross D.C. by Ceres 721 × 112.E.8.L.5., bred and selected at the Plant Breeding Station.

It is a beardless, white-chaffed, white-grained wheat of fair or better straw length, maturing in approximately 5¾–6 months at Njoro, 7,100 ft. It has full resistance to the eight biologic forms of black stem rust occurring in the Colony, is fairly resistant to leaf rust and shows resistance to yellow ear rust up to approximately 8,000 feet in Kenya.

318.AJ.4.A.1 has done well in large-scale field trials at Njoro and should be suitable to all areas in Kenya between 6,500–8,000 ft. approximately having a growing season of about six months' duration.

The grain is acceptable to the mills.

Approximately 2,000 bags are available for distribution.

Wheat No. 261.R.7.C.1.B.—A selection out of the cross 68.E.12.A.1 × Reliance, bred and selected at the Plant Breeding Station. It is a bearded, white-chaffed, light red-grained wheat maturing in the same time as Kenya Governor, i.e. four months approximately at 6,000 ft. in this Colony. The straw tends to be weakish.

It has full resistance to seven biologic forms of black stem rust occurring in the Colony and is probably resistant to the newest eighth form. It is fairly resistant to leaf rust and to yellow ear rust up to approximately 7,000 ft. in Kenya.

This wheat has done well in large-scale field trials at Rongai during the 1948 season and should be suitable to all areas in the Colony between 5,000–7,000 ft. having a growing season of about four months' duration.

The grain is of good quality and is acceptable to the mills.

Approximately 1,000 bags are available for distribution.

Wheat No. 117.A.II (Pure or Regenerated).—A single plant selection from 117.A. Straw strength, disease reactions and grain quality are all roughly equal to those of 117.A.

The crop, being the produce of a single plant, is pure and uniform. This selection should be suitable for all areas in which 117.A. is grown and provides a source of pure seed for farmers wishing to renew their stocks of this variety.

Approximately 1,200 bags are available for distribution.

Wheat Rhodesian Sabanero.—A direct importation from Southern Rhodesia multiplied up from one single plant selection. Straw strength, disease reactions and grain quality are all roughly equal to those of ordinary Sabanero.

This selection should be suitable for all areas in which Sabanero is grown and provides a source of pure seed for farmers wishing to renew their stocks of this variety.

Approximately 500 bags are available for distribution.

Wheats Under Multiplication With Farmers

The following wheats were increased by farmers, under departmental control, during the season. The number of bags of each reaped is given in brackets. If these varieties continue to yield satisfactorily on a field scale in 1949 it is the intention to release them for general cultivation.

338.AC.2.E.1 (60 bags).—A selection from the cross 192.Q.2.A.L × Australian 27/2.2.1.5. This wheat was multiplied up by a grower at Ulu in Kenya during both the 1948 long and short rains season. He averaged 10½ bags per acre, Kenya Governor yielding seven bags per acre under comparable conditions.

The variety possesses good straw and is of good baking quality. The cross was made to suit short season conditions, although it will also be of use in the lower areas of Kenya up-country wheat districts.

The further selection, 338.AA.1.A.2, mentioned in the 1947 report as under multiplication at Ulu, was destroyed by army worm and a fresh start is being made with bulking.

321.BT.1.B.1 (60 bags).—A selection from the cross Australian 45.C.5 × 117.A. This wheat has better straw than 117.A and was bred to replace this variety in the medium and lower wheat growing areas.

It shows resistance to leaf rust and is of moderate quality.

294.H.2.A.1. and 294.M.7.C.1.C (300 bags of each).—These are both selections from the cross Australian 26.A × 117.A being of early medium and late medium maturity respectively. Both are of moderate quality and have done well in preliminary field scale tests.

360.H (30 bags).—A selection from the cross 294.M.7.C.6.C × 184.P.2.A.1.E designed to keep the yield and straw strength of 294 and combine them with the good baking quality of the 184 parent.

291.J.1.1.1.1.1 (60 bags).—A bearded selection from the cross Australian 26.A × 58.F (L.1). This selection has yielded well in small-scale trials and in the field.

318.0.3.B.2 (200 bags).—This hybrid from the cross D.C. by Ceres 721 selection × 112.E.8.L.5, although of somewhat weaker straw, has more resistance to yellow ear rust than the sister strain, AJ.4.A.1, released this season and can be grown up to 8,500 ft. in Kenya. It has yielded well in preliminary experimental and field tests in the Ol Kalou area.

337.BE.2.F.2, 341.F.2.D.1 and 350.AD.9.C.2.—These three wheats came top in the yield trial at Molo in 1947 and were increased during the present season. The first two again yielded well in the 1948 yield trial (*see* Molo Yield Trial). They will be further tested out in various areas of Kenya at about 9,000 ft. in 1949 and increased in quantity. It is possible they may be of value as a substitute for Equator in the higher areas. Their breeding and the number of bags of each are:—

337.BE.2.F.2 (30 bags)—223.F.1.A.3 × 291.J.1.B.1.

341.F.2.D.1 (10 bags)—279.I.5.F.2 × Eureka G. 2503.

350.AD.9.C.2 (15 bags)—223.F.1.A.3 × 294.M.7.C.8.

All are of moderate quality.

Pedigree Seed.

291.J.1.I.1.II (*Pure or Regenerated*).—A single plant selection from 291.J.1.I.1 made to purify the strain. Yield, performance and quality are roughly the equal of the parent strain.

The 250 bags reaped are being further bulked up in 1949 for release to farmers in 1950.

Wheat Breeding at the Plant Breeding Station, Njoro—7,100 ft.

New Hybrids and Importations Undergoing Multiplication.

D.C. × *Ceres 721.*—Four rust resistant selections have reached the bag stage.

355.AZ.1.—A selection from the cross 291.J.1.I.1 × 117.A. One bag has been reaped.

351.AS.1.B.2.—A selection from the cross 117.A × Regent 975.6. Four bags have been reaped.

Newthatch. C.I. 12318.—A hard red American spring wheat. Five bags have been reaped.

Carleton. C.I.12064.—An American durum wheat. Six bags have been reaped.

Yields of Some Newer Hybrids.

The following table gives yields of some of the newer hybrids at Njoro, 7,100 ft., and at Rongai, 6,000 ft.

Variety	Njoro, 7,100 ft. Yield Bags per acre	Rongai, 6,000 ft. Yield Bags per acre
294.M.7.C.1.C	12·8	—
291.J.1.I.1.I.1	12·3	—
318.AJ.4.A.1	11·9	—
294.M.7.C.6.A	11·5	—
321.AO.1.C.3	11·3	—
360.H	11·3	—
291.J.1.I.1 Selected	11·1	—
Sabanero Rhodesia	11·0	—
261.R.7.C.1.B	10·9	5·0
294.H.2.A.1	10·8	5·5
Newthatch	10·8	—
294.H.2.A.1 Selected	10·6	—
291.J.1.I.1	10·4	8·5
318.O.3.B.2	10·2	—
294.B.2.A.3	10·0	5·8
321.BT.1.B.1	9·1	—
117.A Selected	9·0	8·4
Sabanero	8·8	—
117.A	8·7	—
	P.05=1·0 bags per acre. P.01=1·3 bags per acre.	P.05=1·2 bags per acre. P.01=1·6 bags per acre.

Low yields at Rongai are due to early planting and the May drought.

It is of interest to note that at Njoro a number of the newer hybrids have yielded considerably better than the standard varieties 117.A and Sabanero.

Cage Material.

The following crosses are in F.2:—

No. 363—Warigo × 261.S.10.C.2.D.
No. 364—Warigo × 261.S.10.C.1.A.
No. 365—Warigo × 261.R.7.C.1.B.
No. 366—Warigo × 294.B.2.A.3.
No. 367—Warigo × 184.P.2.A.1.F.

They aim to combine the leaf rust resistance of Warigo with strength of straw and baking quality.

The following crosses have now reached F.4:—

No. 352—Warigo	×	117.A.
No. 353—291.J.1.I.1	×	Warigo.
No. 354—Warigo	×	Sterling.
No. 355—117.A	×	291.J.1.I.1.
No. 357—184.P.2.A.1.E	×	294.AN.4.A.1.
No. 359—291.J.1.I.1	×	184.P.2.A.1.E.
No. 360—294.M.7.C.6.C	×	184.P.2.A.1.E.

Here again the Australian parent Warigo has been used as a source of leaf rust resistance. Many of the cultures now appear to be fixed and will be carried forward into the multiplication plots in 1949. One selection in the cross 360, 360.H, was apparently fixed in F.2 and is being bulked up on a field scale (see earlier).

The Russian amphidiploid, *Triticum timococcum,* was used as the female parent in the cross with Marquis in 1947. The few seeds obtained were sown in 1948 and part of the plants left to self. These produced no seed. The remainder were back-crossed to Regent 975.6 and Newthatch. These produced seed which will be sown this coming season.

New Crosses.

The following new crosses were made:—

No. 372—184.P.2.A.1.E	×	Newthatch.
No. 373—Newthatch	×	117.A.
No. 374—Newthatch	×	192.Q.2.A.L.
No. 375—Newthatch	×	294.AI.5.G.2.
No. 376—Cobbs 1066	×	Regent 975.6.
No. 377—Regent 975.6	×	291.J.1.I.1.
No. 378—Kenya Governor	×	Regent 975.6.
No. 379—261.S.10.C.2.D	×	Regent 975.6.
No. 380—261.R.7.C.1.B	×	Regent 975.6.
No. 381—184.P.2.A.1.E	×	Regent 975.6.
No. 382—294.AI.5.G.2	×	Regent 975.6.
No. 383—Warigo	×	Regent 975.6.
No. 384—318.O.3.B.2	×	Equator II.
No. 385—318.AJ.4.A.1	×	Equator II.
No. 386—192.Q.2.A.L.	×	Warigo.
No. 387—Kenya Governor	×	291.J.1.I.1.
No. 388—294.AI.5.G.2	×	291.J.1.I.1.
No. 389—261.R.7.C.1.B	×	291.J.1.I.1.
No. 390—261.S.10.C.2.D	×	291.J.1.I.1.
No. 391—261.R.7.C.2.	×	291.J.1.I.1.
No. 392—Newthatch	×	294.AN.4.A.1.

Without going into detail, this series of crosses is designed to combine the raw strength and baking quality of the one parent, particularly Regent, with the ust resistance of the second.

nportations.

The following wheats were under trial for the first time:—

From Professor Waterhouse, Sydney, New South Wales.—Twenty-two ybrids chiefly of Australian × Kenya wheat crosses. They were mostly of poor rowth and some were attacked by stem rust. Nabawa × Kenya 745 appeared the ost successful.

From the Central Experimental Farm, Ottawa, Canada.—Cascade C.A.N. 593.—Had weak straw and stem rust with pustules of the R/S type. It yielded hite plump grain of attractive appearance.

Saunders C.A.N.3516.—The straw proved strong and the variety was not ttacked by stem rust. It suffered some glume blotch infection, *Septoria nodorum*, nd the red grain was pinched.

From the Department of Agriculture, Victoria.—Diadem.—Good straw but adly rusted.

From Dr. C. H. Goulden, Winnipeg, Manitoba, Canada.—Redman, C.A.N. 633.—Good straw and no rust except on one plant. Some glume blotch.

From the Economic Botanist, New Delhi, India.—Eighteen durum wheats .D. Nos. 34, 101, 104, 111, 119, 128, 133, 134, S.40, Shetgahoo, Jappa, Punjab ype 1, Athani, Jaya, Baxi Local, Vijaya, Niphad 31 and Baxi 33.

From the State of Arizona, U.S.A.—Marfed, C.I.11919.—Weak straw, bad lume blotch and rust attack.

All the above varieties will be again under test in 1949.

Wheat Breeding at Low and High Altitude Sub-Stations

cott Agricultural Laboratories (5,700 ft.).

Cross No. 339 (192.Q.2.A.L. × Australian 37.2.5.4) stem-rusted badly in the ages during the season and for the first time. Tests show the form to be K.8. is likely, therefore, that this cross will have to be discarded. A few of the egregates which appear to show some resistance will be carried on and re-tested 1949.

Both cross *No. 356* (184.P.2.A.1.F × 192.Q.2.A.L) and *No. 358* (184.P.2.A.1.F 294.B.2.A.3) remained free of stem rust. Segregates have now reached F.4 and ie most promising will be carried on to multiplication plots in 1949.

Both Regent and Newthatch, the former released to farmers from departmen- l control in 1946, the latter still under test, rusted in the cages the form being K.8. ewthatch was less affected than Regent which showed large susceptible-type ustules.

The Australian wheats Gabo, Kendee, Yalta, Charter and Celebration were l attacked to a greater or lesser extent by rust, the pustules being numerous nd of the R or R/S type.

olo (9,300 ft.).

At the higher altitudes yellow rust resistance becomes of the greatest import- nce in the breeding programme and is a limiting factor in wheat production in ch areas. Varieties which do not possess some resistance are liable to be damaged even completely destroyed. Equator is still the mainstay of the wheat growing eas over 8,500 ft. and it is commonly grown in the Plateau area down to 7,000 ft.

It possesses grain of marked stability and poor quality not liked by the mills. Further it is susceptible to five stem rust biotypes and cannot be considered a safe wheat. As a not inconsiderable proportion of the total wheat production is contributed by Equator—the acreage in 1947 amounted to 15 per cent of the total—there is great need to find a substitute combining good baking quality with stem and yellow rust resistance.

Some results of yield trials carried out on the Molo sub-station at 9,300 ft. over the last two years and on the Government Experimental Farm, Ol Joro Orok, 7,800 ft., in 1948 with some of the new hybrids which is hoped may replace Equator are given below:—

Variety	Molo, 1947			Molo, 1948			Ol Joro Orok
	(1) Yield	(2) Mat.	(3) B. Wt.	(1) Yield	(2) Mat.	(3) B. Wt.	(1) Yield
341.F.2.D.1*	13·3	207	61	8·7	215	61	7·7
337.BE.2.F.2* ..	13·1	185	58	9·7	215	60	—
350.AD.9.C.2* ..	12·3	185	61	7·2	215	59	—
337.V.3.B.1	10·5	185	61	9·1	215	59	6·4
340.Y.4.A.1	10·3	207	64	—	—	—	6·4
341.O.2.B.1	9·6	207	63	—	—	—	6·5
Equator II	8·9	244	64	9·1	233	61	4·3
350.AD.9.B.1 ..	7·1	207	63	—	—	—	5·9
337.V.1.B.1	4·9	207	54	—	—	—	8·2
337.V.3.A.2	2·9	207	48	—	—	—	5·5
337.V.3.A.1	1·4	207	41	—	—	—	4·2
337.AB.2.B.1	—	—	—	8·6	215	61	—
337.V.2.B.1	—	—	—	8·3	215	61	—
337.C.2.A.2	—	—	—	7·9	215	61	—
337.V.2.B.3	—	—	—	7·1	215	61	—
337.C.2.A.3	—	—	—	7·0	215	61	—
337.AA.1.A.3	—	—	—	6·7	215	59	—
337.AE.2.B.2	—	—	—	5·8	215	60	—
	P.05=1·9 bags. P.01=2·5 bags.			P.05=2·0 bags. P.01=2·5 bags.			P.05=1·1 bags. P.01=1·5 bags.

(1) Yield in bags per acre.

(2) Maturity in days.

(3) Bushel weight in pounds.

* These three varieties are already under multiplication. They have outyielded Equator in the first yield trial and the first two have roughly equalled it in the second. In the field multiplication plots all yielded better than Equator. They are of "filler class" quality with 337.BE.2.F.2 slightly superior.

Baking Quality and Pelschenke Tests

Samples of all advanced hybrid material undergoing multiplication for possible release to farmers is sent, by the courtesy of the millers, Unga, Ltd., Nairobi, to Dr. Kent Jones for a test of baking quality.

In addition, Pelschenke Wholemeal Fermentation Tests are carried out as a routine measure on all new hybrids. These tests serve as a guide to quality in the early stages of selection when material is very limited in amount.

Wheat Rate of Seeding Trials

Trials of varying seeding rates with wheat were laid down by the agricultural officers concerned at Njoro, 7,100 ft., using 294.M; at Eldoret, 7,000 ft., using

N.B.230; and at Ol Joro Orok, 7,800 ft., using D.C. × Ceres. Plots were 1/5 acre each and the trials were arranged as randomised blocks with four replications at Njoro and Eldoret and two at Ol Joro Orok.

Results are:—

Seeding rate per acre (lb.)	Yield Per Acre (Bags)		
	Njoro	Eldoret*	Ol Joro Orok
30	not sown	4·8	9·3
50	13·7	4·8	9·5
70	13·9	5·2	9·3
90	14·4	5·2	9·6
110	14·4	5·5	9·9
130	14·4	5·3	9·4
150	14·6	5·3	9·8
Average	14·23	5·16	9·42
	Differences not sig.	P.05=0·5 P.01=0·7	Differences not sig.

* Low yields at Eldoret due to stem rust and poor soil.

At Njoro and Ol Joro Orok there were no significant differences in yield between the various seeding rates. At Eldoret there were no significant differences in yield with rates from 70 lb. up to 150 lb. per acre. Both the 30 and 50 lb. per acre rates produced equal yields and gave about half a bag an acre less than the higher rates—a significantly lower yield.

In general the heavier seeding rates tended to lodge more than the lighter and matured two to three weeks earlier than the lighter. The year was one of reasonably well distributed rainfall with few heavy storms. In an excessively wet season or in one with frequent heavy falls of rain the results may be different. It will be necessary to carry on the trial for a number of years to smooth out seasonal effects.

Barley

Release of New Varieties.

Two varieties of barley, Research and Glacier, were released to farmers after having been under test and multiplication for a number of years.

Research, a two-row malting type, was received from the State Research Farm, Werribee, Victoria, Australia in 1943. It is a cross between Plumage Archer and Prior designed to combine the quality of the Archer parent with the yield and adaptability of Prior. This barley possesses goodish straw, being better in this respect than Prior, and has broad attractive ears. It has done well both in the preliminary experimental trials and subsequently on a field scale. It has produced plump grain of a mealy cut acceptable to the breweries for malting. Research is about two weeks longer maturing than the standard variety Prior, taking about 144 days at Njoro, 7,100 ft. It should prove a valuable addition to Kenya barleys.

Glacier, C.1.6976, a six-row variety was developed co-operatively by the Montana Agricultural Experiment Station and the United States Department of Agriculture. It was released for production in the U.S.A. in 1943 and received here during the same year. It has consistently yielded well in the yield trials and has kept up its promise on a field scale during the season. It is likely to be a feed rather than a malting barley although plump mealy samples might be accepted in limited quantities for malting. Its good straw and yielding powers make it a valuable feed barley for Kenya.

Yield Trials.

Three barley yield trials were laid down, two at Njoro at different times of sowing and one at Rongai.

Time of sowing	Njoro				Rongai	
	Trial I 19–5–48		Trial II 16–6–48		22–5–48	
	Yield Bags per acre	Bushel Weight	Yield Bags per acre	Bushel Weight	Yield Bags per acre	Bushel Weight
Mariout ..	15·4	46	13·0	44	12·8	45
Kenia ..	15·2	53	14·5	51	7·6	52
Research ..	13·8	52	12·3	51	12·6	52
Abyssinia ..	13·7	46	12·2	41	10·8	46
Glacier ..	13·1	44	9·8	41	10·6	44
Maltworthy	12·3	53	13·1	51	11·2	53
Prior ..	11·7	53	12·0	51	10·6	53
German ..	11·1	50	10·9	51	6·7	47
	P.05=2·1 P.01=2·8		P.05=1·6 P.01=2·1		P.05=1·5 P.01=2·1	

It would appear that in this particular season early sowing gave better results than the later. The better varieties at Njoro are not necessarily the better varieties at Rongai. Kenia has done extremely well at Njoro in both trials for the first time. In past trials this variety has given poor yields in comparison with the others.

It is of interest to note that the newly released variety Research has done consistently well in all three trials and has out-yielded the six-row Glacier in two out of the three trials.

Mariout, a six-row feed barley from Canada now being multiplied up, has yielded well in all three trials.

Barley Importations.

The following 28 barleys were received from the Dominion Laboratory of Cereal Breeding, Winnipeg, Canada:—Vantage, Trebi, Titan, Montcalm, Mars, Wisconsin, Peatland, Gartons, Hannchen, Oilli, Compana, Galore, Tregal, Icelandic, Plush, Colsess, Sanalta, O.A.C.21, Mensury, Canadian Thorpe, Newal, Prospect, Velvet, Velvon, Kindred, Regal, Chevron and Rex. The first eight proved to have better straws. All are six-rowed except Compana, Hannchen and Sanalta, which are two-rowed. These three produced very plump samples of grain although they proved weaker in the straw than the six-rowed types. Mars, O.A.C.21, Newal, Prospect, Velvon, Kindred and Chevron seemed rather weak in the necks. Appreciable rust attacks were suffered by Oilli, Icelandic, Colsess (a hooded variety), Canadian Thorpe, Velvet, Regal, Rex and Gartons.

All will be tried out again in 1949 in large-scale plots. There is much need for feed and malting barleys of high yield and good straw.

Of the barleys received from Dr. Bell, Cambridge, in 1947, both Pioneer and C. R. Dense proved too long maturing at Njoro, 7,100 ft., and took 264 days at Molo, 9,300 ft. It is doubtful if either of these varieties will be successful in Kenya. Prefect, bred by Dr. Bell, produced good heads and this variety together with some others of the English barleys will be included in the 1949 yield trials.

Two barleys from Bolivia, Keara cebada and Cebada forrajera were not successful.

Oats

The season has been a good one for oats heavy yields being recorded from some areas. Milling oats have, however, been rather thin and early parcels offering to the mills are of poor quality.

A Milling Oats Committee, under the chairmanship of the Senior Plant Breeder, was set up to ensure that the quality of milling oats was impartially assessed and to decide how much of the Sh. 3 bonus per bag should be paid for extra quality.

Lampton, from Australia, is still the standard variety for feed and hay with Grey Algerian as the milling variety. Achilles, an awned variety from New Zealand, was increased for possible release to farmers but a final decision has been postponed for a further season. Some farmers have complained that the awn is difficult to remove at threshing whilst other growers have had success by running the drum of the combine harvester fast and the concaves of the machine set closer. Achilles does not seem such a heavy yielder as Lampton and is weaker in the straw but has produced plumper grain than Lampton in the Molo/Mau area where trials have chiefly been carried out. It is a feed oat and is not acceptable for milling on account of the strong black awn.

The following American and Canadian varieties were under test at Njoro and Molo and were all infected by stem rust to a greater or lesser extent:—Ajax R.L.1114, Exeter R.L.53, Hancock C.I.3346, Marion C.I.3247, Fultex C.I.3531, Vicland C.I.3611, Boone C.I.3305 and Cedar C.I.3314.

The six Canadian R.L. oats, Nos. 1710, 1681, 1674, 1692, 1734 and 1694 were again under test at Njoro and Molo. As in previous seasons all rusted although R.L. Nos. 1710 and 1734 proved more resistant.

Oat Importations.

The following oats were under trial at Njoro for the first time:—

From the U.S.D.A., Washington, D.C., U.S.A.—Control, Vikota and Tama. All were found to have weak straw under Kenya conditions. The first two suffered slight rust attack whilst Tama remained free of rust.

From the Department of Agriculture, Melbourne, Australia.—Orient. This oat had a slight rust infection and was weak in the straw. It has a large black awn.

From the Salisbury Experiment Station, Southern Rhodesia.—S.E.S. Nos. 52, 387, 389 and 416, the last three being huskless. All were found to be extremely susceptible to rust and were weak in the straw.

These varieties will be tried out again in large-scale plots in 1949.

Semi-Dwarf Sunflowers

Three semi-dwarf sunflower varieties were imported from U.K. and tested in yield trials at Njoro, 7,100 ft., and Kitale, 6,000 ft., against the standard Russian Giant Black variety. Yields at Njoro were:—

	Yield per acre (Bags of 100 lb.)	Time to maturity	Oil content per cent	
			As received	Once grown
Giant Black ..	14·0	6 months	27·7 (6·7)*	26·8 (9·0)*
Mars	9·9	5 ,,	28·7 (6·9)	30·4 (6·7)
Jupiter	8·3	5 ,,	30·3 (6·8)	28·4 (8·4)
Pole Star.. ..	7·4	5 ,,	27·2 (6·4)	26·6 (7·3)
	P.05=4·5 bags. P.01=6·0 bags.			

*Figures in brackets are the moisture contents of the seed.

It is seen that the dwarf varieties have retained their old content after once growing.

At Njoro, as in other centres, the dwarfs were considerably lower yielding than Giant Black and the reason probably lies in the spacing which was the same for all varieties, i.e. 3 ft. between rows and 1 ft. in the row. Subsequently trials will be carried out with the dwarfs spaced much more closely, i.e. 16–18 in. between rows and 8 in. in the row.

At Rongai and Kitale times to maturity were dwarfs 4 months, Giant Black 5 months; at Ol Joro Orok, 7,800 ft., dwarf 5½ months, Giant Black 7½ months; and at Molo, 8,000 ft., 5 and 7 months respectively.

The seed of the dwarf varieties was commercial seed and showed considerable unevenness in ripening but was better in this respect than the Giant Black. Single plant selections have been made in the various strains. A small quantity of selected seed is to be imported from Cambridge.

Bulking plots of the three dwarfs have yielded several sacks of seed and these have been given out to farmers for bulking over the 1948–49 short rains season. If bulking goes according to plan there should be sufficient seed of all varieties to meet the Colony's requirements after the 1949 harvest.

The advantage of the dwarf types lies in their more even ripening and in the possibility that they can be harvested mechanically, an essential point in these days of labour shortages if the crop is to increase in popularity.

Soya Beans

The following soya beans from the U.S.A. were under trial at Njoro, Rongai, Ol Joro Orok, Eldoret and Kitale:—Mamloxi, Avoyelles, Ogden, C.N.S., Roanoke and S.100. They were inoculated with the inoculant supplied by the dispatching firms. Growth was poor and the yield of grain extremely small at all stations except at Eldoret where the first four appeared to show promise for bean yield and the first three for hay. Ol Joro Orok growth was very slow and some varieties refused to flower.

Further batches of soya beans were received from the College of Agriculture, Potchefstroom, South Africa and the Salisbury Experiment Station, Southern Rhodesia, and were sown at Njoro and Rongai. The varieties were—34.S.51, 34.S.395, 35.S.277, 38.S.5, 39.S.11, 40.S.35, 41.S.31, 41.S.77, 42.S.6, 44.S.36, 45.S.2, 45.S.95, 45.S.96, 45.S.100 and 45.S.101, and Hernon Nos. 18, 55, 107, 116 and 279. These were received somewhat late in the season and did not have a fair trial.

All varieties will be grown again under test in 1949.

Maize

Maize yields have been above average in the main producing areas although crops in the lower rainfall districts of the Colony are lighter than normal on account of the May drought.

Hybrid Maize Trials.—The hybrid maize varieties from the U.S.A. described in the 1947 Annual Report were again under test. They comprise Texas Yellow Hybrids Nos. 10 and 12, Texas White Hybrid No. 9, White Hybrid Field Corn No. 9W, Yellow Hybrid Field Corns Nos. 12 and 18 and Field Corns Nos. W19 and W59. All were severely attacked by rust and white blight both at Rongai and Njoro and their performance was poor in comparison with local maize. Texas Yellow Hybrid No. 12 put up the best performance. A hybrid from Southern Rhodesia, N3-1 × M9-9, looked promising in the trial plots and will be further tested next season. It is not surprising that the Rhodesian hybrid yielded better than the American since the Rhodesian climate is nearer our own and maize is known to be very sensitive to changes in environment.

Golden Bounty from England failed completely, flowering at 2 ft. high and producing no seed.

Three hybrids from Potschefstroom were received too late in the season for planting—(B33 × B34) × (B35 × B36), (A372 × A373) × (A346 × A350) and (A372 × A373) × (A346 × A366). They will be tried out in 1949.

It is considered that the importation of hybrid corns produced in other countries is unlikely to lead to success and that efforts would best be concentrated on *ad hoc* breeding work using chiefly local strains. It is intended to re-start this work in 1949 but until such time as hybrids of good yielding qualities are produced—the work is likely to take 15 years and upwards and success is by no means assured—farmers are advised to practise yearly selection of their seed maize on the lines advocated by us and described in *K.I.O. Fortnightly* No. 98 of 5.12.46.

Maize Seed Competition.—Owing to lack of staff this competition was in abeyance last season.

Pyrethrum

The 1,000-odd single plant selections made in 1946 when the pyrethrum work was re-started after the lull caused by wartime staff shortages have been whittled down to about 400 which are still under study. All flowers produced on these lines are picked, counted and weighed and their pyrethrins contents determined at intervals so that at the end of the season there is a comprehensive picture of the performance of every line. Those lines which do not come up to standard are discarded.

The following table shows the numbers of selections at the two stations which have pyrethrins contents ranging from 2 per cent to 2.5 per cent and over:—

Pyrethrins Contents	Molo	Ol Joro Orok
2% – 2·5%	45	83
over 2·5%	11	19
Total number of selections under study	189	211

The most promising lines of highest pyrethrins contents have now been planted in pairs in isolated plots for seed production. There are 20 of these isolated plots at Ol Joro Orok and nine at Molo and Subukia, at which latter substation strains are tested under low altitude conditions. Seed from some of these plots has already been sown in the nursery to produce seedlings in preparation for field trials in 1949.

At Molo nine crosses are being compared in a progeny yield trial. Of these three have given pyrethrins contents of over three per cent and four over two per cent. Those crosses of particular promise are 188 × 214, 188 × 194, 188 × 213 and 145 × P. It is of interest to record that the line P., a very vigorous strain with a low pyrethrins content, used in a number of trial crosses, has invariably lowered the content of the progeny and this emphasizes the need for high pyrethrins content in both parents for the production of high pyrethrins content in the progeny. Line P. has been used in the crossing programme entirely for its sturdy growth, large flower size and quite exceptional vigour in an attempt to combine these qualities with an increased pyrethrins content.

As a result of the season's work lines 145, 188, 194 and 214 are being increased for the establishment of large-scale seed plots. If all goes according to plan it should be possible to make a seed issue to growers from these improved lines in 1951–52.

Acknowledgments

My thanks are due to Dr. R. M. Nattrass, Senior Plant Pathologist, for testing and identification of physiologic stem rust forms and for the production of material for artificial rust epidemics in the breeding cages: to Mr. W. H. Hewitt, Assistant Agricultural Officer, for help with the sowing and harvesting of wheat at the Scott Agricultural Laboratories; and to the officers of the Pyrethrum Stations, Mr. E. W. Gaddum and Dr. U. Kroll, for help in planting and recording the pyrethrum breeding material.

H. C. THORPE,
Senior Plant Breeder.

ANNUAL REPORT OF THE OFFICER IN CHARGE (COFFEE SERVICES), 1948

Staff

The staff position at the end of the year was as follows:—

Officer in Charge—A. R. Melville (Senior Entomologist (Coffee)).

Agricultural Officer—P. A. Jones.

Entomologist—Vacant.

Plant Pathologist/Physiologist—R. W. Rayner.

Agricultural Chemist—H. C. Pereira.

Senior Assistant Agricultural Officer—E. Cottington.

Assistant Agricultural Officer—J. R. Russell.

Clerk in Charge—J. E. West.

Field Assistant—A. G. C. Hunt.

Junior Laboratory Assistant—A. R. Killick.

Mr. Rayner proceeded on vacation leave in July and was absent for the remainder of the year. Mr. Schouten left Kitale in July to attend a course at the Imperial College of Tropical Agriculture in Trinidad, British West Indies. His place at Kitale was taken by Mr. Russell, who joined the Coffee Services in January. Mr. C. W. Shorman, Junior Laboratory Assistant, resigned in March, 1948, and Mr. Killick filled the consequent vacancy in November.

Rainfall Records at the Coffee Research Station, Ruiru, and Sub-Stations

The following table shows the monthly rainfall distribution for six stations:—

A—Coffee Research Station, Ruiru.

B—Scott Laboratories, Kabete.

C—Agricultural Department, Kitale.

D—Anmer Estate, Kiambu.

E—North Kitito Estate, Makuyu.

F—Kapretwa Estate, Elgon.

	A	B	C	D	E	F
January	0·00	0·00	0·33	0·02	0·00	0·44
February	0·44	0·33	0·76	0·58	0·47	1·54
March	2·80	3·59	1·66	2·71	4·95	3·03
April	7·02	8·97	4·05	6·38	5·26	5·49
May	2·71	4·48	3·01	4·85	2·60	4·60
June	2·17	3·55	4·79	2·29	0·59	4·97
July	0·35	0·11	11·68	0·34	0·04	5·40
August	0·45	3·18	8·05	0·69	0·09	6·05
September	1·20	0·88	4·13	0·46	0·00	4·57
October	4·32	2·49	5·54	4·42	6·63	8·37
November	4·64	3·66	0·58	5·58	8·66	0·98
December	5·73	7·97	0·14	7·38	11·38	0·08
Total	31·83	39·21	44·72	35·70	40·67	45·52
Number of days	102	110	149	119	81	171

Development of the Coffee Research Station, Ruiru

During the year the headquarters of the Coffee Services were more firmly established at Ruiru on the new research station. After many delays, a start was ultimately made on the main administrative and laboratory buildings in December.

Mr. Rayner and Dr. Pereira continued to work at the Scott Agricultural Laboratories during the year, as no laboratory facilities were available at Ruiru.

The staff houses of the second contract were completed early in 1948, bringing the total number of staff houses to eight, to which must be added the hostel, built by our own artisans out of funds provided by the Coffee Board of Kenya.

Good progress was made with the programme of African housing and farm buildings for which D.A.R.A. funds had been provided. A new coffee factory, designed to deal with all aspects of experimental work as well as the bulk commercial crop of the estate was taken to such a stage that it could be used for the 1948/49 crop and, although much remains to be done on it, we already have the basis of a very good factory. Work was commenced on a new stone layout for compost making, designed by Mr. Jones, Agricultural Officer, and arrangements have been made for the provision of a garage, tractor house, implement shed and an isolated petrol and oil store. It is hoped to complete the development of Jacaranda Estate in 1949, so that, with the completion of the laboratory and administrative buildings, the staff will be able henceforward to concentrate on research and extension work.

Fencing development and road making have been taken a stage further. The usual tree planting programme was carried out but owing to the failure of the long rains the results achieved were very poor.

In December, arrangements were made for the Coffee Services to take over, as from 1st January, 1949, the neighbouring Rukera Estate. The reasons for the purchase of this estate by Government were—

(*a*) that the available land on Jacaranda Estate was inadequate for experimental purposes. A portion of Rukera Estate, some of it virgin land suitable for coffee growing, will be added to Jacaranda Estate and there will thereafter be plenty of room for developments on the research side;

(*b*) that experience has shown the great desirability of separating research from demonstration in order to achieve the best results in either sphere. Accordingly it is the intention that the greater part of Rukera Estate should be developed as a farm on which proved practices can be demonstrated. Coffee will be the main crop but it is intended that the activities of the demonstration farm should not be confined to coffee alone but should include a commercial dairy and, in time, fruit growing, poultry, etc.—in short, a regional demonstration farm to cover a whole range of activities. It is confidently felt that this division of activities as between the research station and the demonstration farm will be of great value to farmers and research workers alike;

(*c*) that it will provide a site for the district headquarters of the Soil Conservation Service. It is most important that these headquarters should be so conveniently situated in the centre of the East Rift coffee area, readily accessible to planters and conducive to close liaison between Soil Conservation Officers and research and extension officers of the Coffee Services;

(*d*) that it will be possible to use an area of up to ten acres on the Ruiru River for a sub-station devoted to fruit growing, a project which has been held up for want of a suitable site. The Agricultural Officer (Horticulture), has examined the proposed site and pronounced it admirably suited to the purpose.

Field Experiments on the Coffee Research Station and Sub-Stations

A description of the progress made on the field experiments and an analysis of results and conclusions to date have been given separately in reports from the Officers concerned.

During the year, the sub-stations at Kentmere Estate, Kiambu and Karimani Estate, Thika, were closed down.

The following sub-stations will continue to be operated:—Kitale Experimental Station, Kapretwa Estate, Mount Elgon, Anmer Estate, Kiambu and North Kitito Estate, Makuyu.

Entomology

As the Senior Entomologist (Coffee) has continued to be in charge of the Coffee Services and the whole development project at the Coffee Research Station and as no second Entomologist has been appointed, very little investigational work has been possible on the entomological side. It is proposed therefore to record all entomological matters in this report because there is insufficient material to justify a separate entomological report.

The official recommendation for the control of *Antestia* has been, and still remains, routine sampling using pyrethrum extract in kerosene and, if the average number of *Antestia* per tree exceeds two, general application of pyrethrum powder at the rate of 8–10 lb. per acre. Given good quality finely ground pyrethrum powder, it has been repeatedly demonstrated that a satisfactory control of *Antestia* can be achieved provided that routine sampling is carried out and treatment applied immediately the average number per tree exceeds two. Planters have become dissatisfied with the pyrethrum control method for the following reasons:—

1. Variable quality of pyrethrum powder supplied. (Recently an improved specification has been laid down and a considerable improvement in supplies has been noted.)
2. Failure to carry out routine sampling. This means that the control method is being used blindly without any means of measuring either the need for or the result of control measures.
3. Failure to appreciate that this control method is most efficient when, following routine sampling on a monthly basis, control is carried out *whenever* the danger number is passed. When the *Antestia* population is allowed to get out of hand, two or more applications at short intervals may be needed to effect control.
4. The expense of the method.
5. The feeling that a higher degree of control might be attained if D.D.T. and B.H.C. were used and that, because of the much greater persistence of such insecticides, populations could be kept below the economic danger level with fewer treatments.

While continuing to recommend the pyrethrum method, the policy has been to carry out investigations aimed at improving the control of this pest whenever there was any opportunity to do so.

An *Antestia* outbreak on a neighbouring plantation, where there was available a large block of single stem coffee trees with an average population of 35 bugs per tree, gave an opportunity to carry out two field experiments as part of a thorough investigation of the possibilities of D.D.T. and B.H.C. insecticides.

Experiment No. 1.

Carried out between 2nd and 9th June, 1948.

The insecticides used were:—

(1) *D.D.T. Emulsion.*—Prepared according to the formula given by F. B. Notley, Entomologist, Coffee Research Station, Lyamungu, T.T., in the Coffee Board Bulletin for October, 1947. Lighting kerosene was used in place of power kerosene. The D.D.T. used was 77 per cent active material. It was applied at the rate of one pint of emulsion per tree. This insecticide is rather troublesome to prepare.

(2) *Pyrethrum Powder.*—The powder used was obtained through the ordinary trade channels and was therefore typical of what the planter was being supplied with at that time. Applied at the rate of 6 lb. per acre (in estate practice 8 lb. per acre is the usual figure). The pyrethrin content of this sample was subsequently found to be much higher than average but the behaviour of the powder in the hand pumps used (Waldron) indicated that it was not ground finely enough.

(3) *Agrocide* 3.—Supplied for trial purposes by Messrs. Plant Protection Ltd. Applied at the rate of 9 lb. per acre. This powder was easy to apply.

The design of the experiment allowed for sampling the *Antestia* population before treatment, 48 hours after treatment, and seven days after treatment.

The conclusions reached were—

(*a*) that all three treatments significantly reduced *Antestia* populations over both 48 hours and seven days;

(*b*) that after 48 hours the effect of the D.D.T. (85.8 per cent reduction) was greater than that of Pyrethrum (82.4 per cent) which was in turn greater than that of "Agrocide 3" (38.7 per cent). All these differences being statistically significant;

(*c*) that after seven days, the effect of D.D.T. (93.2 per cent reduction) was significantly greater than that of either "Agrocide 3" or Pyrethrum; the effects of the latter were not significantly different from each other.

Experiment No. 2.

Carried out between 21st June and 7th July, 1948.

The insecticides used were:—

(1) *Pyrethrum Powder.*—Applied at the rate of 7 lb. per acre.

(2) *Pyrethrum Powder.*—(Identical sample to above) with the addition of the synergist Piperonyl butoxide at the rate of one per cent. This substance is added to prolong the effectiveness of the pyrethrins. Applied at the rate of 7 lb. per acre.

(3) *Agrocide* 3.—(Plant Protection, Ltd.). Applied at the rate of 12 b. per acre.

(4) *Agrocide Wettable Powder.*—Applied at the rate of one pint per tree of a mixture of 4 lb. powder in 100 gallons of water. This insecticide was easy to mix and apply and the suspension did not separate out on standing.

(5) *D.D.T.* (*50 per cent*) *Wettable Powder.*—(Supplied for trial by Messrs. Stafford Allen). Applied at a concentration of 0.1 per cent D.D.T. in water and at a rate of one pint per tree. Separated out rather quickly but otherwise easy to mix and apply.

The design of the experiment allowed for sampling the *Antestia* population—

(i) before treatment;

(ii) at 48 hours after treatment;

(iii) at seven days after treatment;

(iv) at 14 days after treatment.

The conclusions reached were—

(*a*) that immediate effects were significantly best for Pyrethrum Powder, "Agrocide" Wettable Powder and Pyrethrum Powder plus Piperonyl butoxide;

(*b*) that at seven days, "Agrocide" Wettable Powder and D.D.T. (50 per cent) Wettable Powder were better than Pyrethrum. "Agrocide 3" and Pyrethrum plus Piperonyl butoxide were not significantly better than Pyrethrum Powder;

(*c*) that at 14 days, all treatments used were better than Pyrethrum and that "Agrocide" Wettable Powder and D.D.T. (50 per cent) Wettable Powder were significantly better than the other three.

The experimental results given above, though they do not represent a complete investigation, give an interesting indication of the possibilities of these insecticides. In Experiment No. 1, the efficacy of the D.D.T. method introduced by Notley in Tanganyika was confirmed. In Experiment No. 2, another form of D.D.T. which is much easier to use than the Notley formula also gave very good results. "Agrocide" Wettable Powder was perhaps the most promising insecticide under the conditions of the experiment. "Agrocide 3", an insecticide already much appreciated by planters in other connexions, did not give very good results in these two experiments perhaps because the rate of application was too low. With regard to pyrethrum, though the insecticide did not show a greater immediate effect in Experiment No. 1 than Notley's D.D.T., in experiment No. 2 both pyrethrum alone and with Piperonyl butoxide produced a satisfactory immediate effect and addition of the synergist was found to prolong the effectiveness of the pyrethrum.

Further work has been planned with a view to assessing the full residual effect of various D.D.T. and B.H.C. insecticides and the effect of their continued use over a long period will also be studied.

Coffee is a crop notorious for the extent of its associated insect complex and the importance of biological control is great, and, as is already well known, this is especially true in the main East Rift coffee area where the common coffee mealy bug exists. The use of persistent insecticides might well interfere seriously with this control and, accordingly, the policy of the department is to advocate caution regarding their use pending the acquisition of much more accurate knowledge.

Lygus coffeæ required control measures in several districts. The mealy bug position improved very considerably during the year most probably because, as a result of extension work, there has been much better attention on the part of planters to the dangers of sucker growth. It has been pointed out in previous reports that breakdowns in the control by *Anagyrus nr. kivuensis* Comp. caused by the hyperparasite *Pachyneuron* sp. generally occur when mealy bug has developed on sucker growth. Good cultural practice nowadays entails the regular removal of suckers from coffee grown on the single stem system and on the multiple stem system retention of essential suckers only and treatment of these with methylated spirit at monthly intervals until the growth becomes more mature. Routine examinations of mealy bug samples have shown that in general *Anagyrus kivuensis* continues to exert a perfectly satisfactory control over the mealy bug. Cases of parasite breakdown, though sometimes serious locally, represent a very small percentage of the East Rift coffee area.

Coffee Thrips (*Diarthrothrips coffeæ* Williams) did not cause any serious losses during 1948, but the number of planters who carry out precautionary spraying with the Paris Green/Molasses spray, increases annually. This practice has been recommended by the Department since 1945.

In the Trans Nzoia, a pest which was first noticed to be causing considerable damage to coffee cherry in the 1947–48 crop, was again observed in the 1948–49 crop. Considerable damage has been caused by this pest which in the larval stage bores in the fruit, emerging to pupate. The adult is a small moth which has not yet been identified, and investigations are continuing. Leaf-eating caterpillar (*Epicampoptera andersoni*) has required treatment in several areas.

Testing of proprietary insecticides and equipment has occupied a considerable amount of time.

Plant Pathology and Physiology

Until he proceeded on leave in July, Mr. Rayner was Acting Senior Plant Pathologist in addition to his duties in the Coffee Team.

Certain experiments were initiated on the method of action of copper tonic sprays, which have indicated that the latter act through their fungicidal nature and not because of their copper content. Flowering, growth and soil moisture observations were continued throughout the year.

Whilst on leave in England, Mr. Rayner visited a number of research laboratories where methods and techniques of physiological research were discussed with special reference to coffee physiological problems.

Mr. Rayner's report is given in full separately.

Soil Science

The main lines of investigation carried out by Dr. Pereira have been on soil moisture and fertilizer factors in the nutrition of the coffee crop.

Soil Moisture.—Methods of measurement; conservation by mulching, on both experimental plots and on commercial plantations; effects of drought on the fertilizer responses of the coffee crop.

Soil Structure.—Pore space and crumb structure studies were carried out on the cultivation experiments and on Napier Grass plots.

Fertilizers and Manures.—The trials at the Coffee Research Station continued and were extended to include very heavy soil applications and light foliage sprays of both sulphate and nitrate of ammonia. Mr. Jones undertook all of the picking and crop recording on these trials. Counts were made of dieback and yellowing on many hundreds of trees, foliage samples were tested for nutrients, and herbage cuts were analysed for phosphate uptake by weeds. Copper nutrition and leaf-fall studies at the Scott Agricultural Laboratories were expanded, as a joint experiment with Mr. Rayner, into a detailed study of 72 individual trees.

Deep subsoil sampling showed that coffee was drawing nearly all of its water supply from a depth of several feet, at the time that the crop was maturing. Pits were dug and deep samples taken on all areas for which phosphate trials had been recorded (Ruiru, Thika, Kabete, Kitale and Mount Elgon). These samples were analysed at Amani by Dr Birch of E.A.A.F.R.O., using a new chemical technique.

Quality Factors.—Crop samples were taken on all experiments. Two hundred samples were separately fermented, and hulling loss, clean coffee ratio and grade of beans were measured. One hundred and twenty-five of these samples were liquored by Mr. Devonshire.

Dr. Pereira's report is given in full separately.

Vegetative Propagation

Mr. Cottington's work on vegetative propagation has made such good progress that it is now possible to state that the experimental stage has been passed. Plans are in hand for the extension of the propagating frames and the provision of frames for hardening off the rooted cuttings. Blocks of our best clones are being established close to the frames. Large numbers of rooted cuttings will soon therefore be available for experimental planting. It is hoped to be able to plant commercial blocks of some of the best clones on Rukera Estate in the 1950 long rains. It is also proposed to plant up blocks of cuttings of the best selections so that much larger quantities of first generation seed will be available for sale to growers.

Pasture Improvement, Fodder Cropping and Stock at the Coffee Research Station

Further progress was made with fencing and bush clearing during the year. Two small paddocks near the dairy buildings which were formed by fencing an area sown to Nzoia Rhodes Grass in November, 1944, and which had previously been subjected to too severe grazing, have been brought back into very good condition. This has been achieved by the following sequence:—hard grazing with a large number of cattle followed by resting; cutting of woody weeds and tussocky growth; pre-rains application of sulphate of ammonia; the occasional taking of a seed or hay crop which has given a dense smothering growth of herbage.

The first of the new leys was sown under yellow maize for silage to Nzoia Rhodes Grass and Hunter River Lucerne in the long rains. In spite of the virtual failure of those rains a good paddock has been obtained, the performance of both constituents of the ley being such as to give great confidence for their future in this district. Silage crops were also taken on the second paddock in both long and short rains. This paddock will be sown to grass in 1949. Although rainfall has not been such as to give any crop a fair trial, it would so far appear as if yellow maize is our best possibility for silage.

The first crop of maize silage produced by Mr. Jones was of excellent quality and was eagerly sought after by the cattle in the dry weather at the beginning of 1949. Stock melons, which have been grown on a small area of bottom land bordering a vlei for several years have shown that they are capable of producing a heavy crop, and, as they can be stored for a considerable period without deterioration, they show promise as a reserve succulent feed. Elephant Grass has, as before, shown itself to be an invaluable fodder crop and silage has also been made of this grass. Mr. Jones has carried out preliminary experiments on the use of silage made from coffee pulp as a feed for cattle. This work is reported in detail in his own report.

On the stock side the Boran herd has been maintained. It is hoped that with the formation of an Inter-departmental Livestock Committee consisting of officers of the Agricultural and Veterinary Departments, whose function will be to direct and advise on stock investigational work on Government farms, it will soon be possible to pursue a more positive policy.

Mechanization

No progress was made during the year in the direction of mechanizing the cultural work on coffee on the estate. At the end of the year, however, delivery was taken of a Ferguson TEC narrow tractor as used in the hop fields in England, but although this tractor appears as if it will suit all our requirements, an opinion on its performance must be reserved because it has not yet been tested with its own attached implements. A three-furrow 10-inch plough, a disc harrow and a mower have been ordered. The first two, apart from their general use in the estate coffee, should make the schedule of operations in the cultivation experiment much easier to carry out. At the present time these operations must be carried out with makeshift or borrowed implements. which is a most unsatisfactory state of affairs.

The 1948–1949 Crop Year

Owing to drought conditions, the coffee crop was, generally speaking, disappointing in respect of both quantity and quality, the total crop being just under 7,000 tons. The best quality coffee in the country came from the Kabete area. It is pleasing to be able to record that the African growers at Chogoria were again awarded a Class 2 for certain small out-turns.

On the Research Station at Ruiru, the long rains failed and the short rains, though good, came too late to make any difference to the crop. Just over eight tons of clean coffee were produced.

Advisory and Extension Services

Although it has been difficult to achieve, essential advisory services have been maintained during the year. Mr. Cottington has carried out the general advisory work east of the Rift. In the western area, first Mr. Schouten and later Mr. Russell carried out advisory duties. Mr. Melville has handled a considerable volume of requests for assistance in connexion with pests. Several large estates which have for some time been troubled with mealy bug have been visited and a considerable improvement has been effected. Dr. Pereira has been frequently called upon to act in an advisory capacity.

The following contributions to the Monthly Bulletin of the Coffee Board of Kenya were made by members of the Coffee Services during the year:—

1948

January—"Spraying against leaf rust in East Rift coffee areas" by R. W. Rayner.

January—"Capsid and thrips—A warning to planters" by A. R. Melville.

February—"Tonic Copper Spraying" by R. W. Rayner and P. A. Jones.

March—"Manures and fertilizers" by H. C. Pereira.

March—"Some impressions of a tour of West Rift coffee areas" by A. R. Melville and P. A. Jones.

July—"Programme of investigational work to be carried out at the Coffee Research Station, Ruiru, during the next five years."

August—"Mealy bug: the present position" by A. R. Melville.

August—"Coffee pulp as cattle feed", by P. A. Jones.

October—"Yellowing of coffee" by H. C. Pereira.

November—"Field experiments by coffee planters" by H. C. Pereira.

The Coffee Team assisted the Coffee Board by preparing certain exhibits on coffee matters for the Agricultural Show at Nakuru. In January, arrangements were made for the staging of a tractor demonstration on Jacaranda Estate.

Increasing calls on the staff of the Coffee Services are being made as a result of the extension of coffee growing in native reserves. Mr. Melville, Mr. Jones and Mr. Cottington have carried out tours in native areas during the year.

Coffee Research Committee

This Committee met at the Coffee Research Station, Ruiru, as under:—

11th Meeting—24th January, 1948.

12th Meeting—29th April, 1948.

13th Meeting—20th January, 1949.

The following planters have served on this Committee during the period:—

Mr. G. B. Shields,

Mr. R. V. Lane,

Mr. A. F. Beakbane,

Mr. J. F. Perkins,

Major P. G. McMaster,

Mr. H. A. Delap (*vice* Major McMaster on leave),

Mr. N. R. Solly,

Mr. G. L. G. Shaw (*vice* Mr. R. V. Lane on leave).

The Officer in Charge, Coffee Research Station, Mr. A. R. Melville, has acted as Chairman of the Committee during the year. Members of the Coffee Team have attended meetings by invitation.

The minutes of this Committee have been published in full in the Monthly Bulletin of the Coffee Board of Kenya.

Coffee Planters' Day

A most successful Planters' Day was held on 22nd July at Bendor Plantations, Thika, by the kind permission and under the excellent organization of Mr. G. L. G. Shaw, and was attended by more than one hundred and fifty planters.

Acknowledgments

On behalf of the officers of the Coffee Services, I would again like to thank Mr. Devonshire and the staff of the Liquoring Department of the Coffee Board of Kenya for their help in connexion with the evaluation of experimental samples. This co-operation is much appreciated.

Finally, the Officer in Charge would like to thank officers of the Coffee Services for their co-operation and support throughout the year.

A. R. MELVILLE,
Senior Entomologist (Coffee).

CULTURAL EXPERIMENTAL WORK, COFFEE SERVICES

Rainfall Records

The records taken at the main station and sub-stations are shown in the report of the Officer in Charge, Coffee Services, to which the reader is referred. Excluding the month of December, low rainfall was experienced in the East of the Rift coffee areas. The conditions of drought which prevailed between the main flowering and crop-picking were a limiting factor in most field trials, tending to mask the effects on the quantity and quality of coffee produced due to treatment differences.

Field Trials—Coffee Research Station

Copper Spray Trial I

This trial was continued for the second year. A factorial design of 3 by 3 by 3 with one absolute replication only is used. The treatments are:—

Type of spray—Carbide Bordeaux (T1), Burgundy (T2), Perenox (T3).

Concentration—One per cent (C1), two and a half per cent (C2), four per cent (C3).

Rate of application—Nil (R0), two-thirds pints per tree (R1), four-thirds pints per tree (R2).

As in the first year leaf-fall scores, die-back counts and yield of ripe cherry were recorded. At the peak of the picking season two quality samples were taken. The results of these observations are summarized briefly in Tables 1 and 2, in comparison with those from the previous year. Combined cherry yields for two years are shown also.

Type of Spray.—In all respects except one it is evident that there is no difference between the three types of spray applied. The points for liquoring assigned to T1, T2 and T3 sprays were 139.75, 132.55 and 149.50 respectively: thus trees receiving Perenox yielded a sample of significantly better quality by 6.9 per cent and 12.7 per cent. At the present stage no reason can be offered to explain the nature of this effect.

Concentration.—The intensity of leaf-fall which occurred in the four months following the application of sprays shows a response to the strength of the spray which was the reverse of that in the 1947 season. A great difference between the two seasons probably accounts for this reaction. In the post-rains period of 1947 the incidence of Leaf Disease (*Hemeleia vastatrix*) was high and a large amount of leaf was lost through this cause alone. During the same period in 1948 the disease was absent and a lighter leaf-fall occurred. It is to be expected that the higher concentration of spray would inhibit the spread of Leaf Disease to some extent, and subsequently the fall of leaf due to this cause would be lighter. In the second season the higher strengths resulted in 9 per cent more leaf-fall, an outcome for which further investigation on the function of "tonic" effect is required before the cause can be explained.

Rate of Application.—It is in this respect that the most conclusive results have arisen. Direct and linear responses are visible in most of the observations made. In leaf-fall, dieback (1947 only) and cherry yield, R2 is superior to R1, and both are better than control. In dry seasons quality is normally inversely proportional to the quantity of coffee produced. The relative quality factors from control and sprayed plots in this trial judged by size of bean, hulling loss and cherry/clean coffee ratio were no exception. Whereas the treatments R2 and R1 gave 26.4 and 20.8 cwt. of cherry per acre more than R0 the quality differences appear as follows:—

R0 superior to R1 and R2 by 4.5 per cent of Grade "A" and "B".

R0 superior to R1 and R2 by 4.6 per cent in hulling loss.

R0 superior to R1 and R2 by 12 per cent and 19 per cent cherry/clean coffee ratio.

It is unlikely that the inferior quality of coffee from sprayed plots is due to the direct effects of copper sprays, except that the higher yields stimulated by the use of sprays have led to an inevitable lowering of quality; nevertheless the benefits of copper spraying are clearly illustrated by the relative yields in Table 2.

Copper Spray Trial II

This trial was laid down in May with the object of discovering the optimum time for applying "tonic" copper sprays. From the evidence available it appears that, for maximum effect, sprays should be applied when the rate of growth of the tree is at its peak. This aspect is discussed by the Plant Physiologist and Pathologist (Coffee Services) in his annual report.

For the purpose of this trial the total growing period is divided into three main stages, early, middle and late, each of variable duration in any year. The early stage in 1948 occurred between mid-March and mid-April. The trial commenced after this stage and the appropriate early spray could not be applied therefore. A design of five randomized blocks of seven plots each was chosen for inclusion of the treatments as follows:—

1948—

A. Middle spray.
B. Late spray.
C. Middle + late sprays.
D. Control—no spray.

1949—

A. Early spray.
B. Middle spray.
C. Late spray.
D. Early + middle sprays.
E. Early + late sprays.
F. Middle + late sprays.
G. Control—no spray.

The dates on which sprays were applied were:—middle spray on 20th May, late spray on 15th June.

Scores for leaf-fall, counts of dieback branches and yield of cherry were recorded; the results are given in Table 3.

Leaf-fall.—No significant differences between treatments appear; even the difference between the controls and sprayed plots is negative.

Dieback Branches.—The significant differences were:—D greater than A, B or C from which it may be deduced that sprays lead to lower leaf-fall and a higher leaf/crop ratio in consequence.

Cherry Yields.—Although total yields from the four treatments appear proportional to dieback there was no real correlation between the two; a coefficient of correlation of r = + 0.1719 was not significant.

No preliminary conclusions may be derived from these results. In the analysis the coefficients of variability were lower than average so that it should be possible to detect real differences which arise between treatments in future.

Pruning Trial

Re-establishing Coffee after Stumping.—The trial was continued for the third year; four systems of pruning are compared, viz.:—

A—Multiple stem (three stems).
B—Single stem (uncapped until final height).
C—Single stem (capped thrice before final height).
D—Single two-stem (uncapped until final height).

The four treatments are randomized in six blocks of four plots. Results for the year are given in Tables 4 and 5.

Dieback Branches.—The trees of treatment A suffered severe dieback as in the previous year: the number of affected branches was 505 per cent more than B, 139 per cent more than C and 178 per cent more than D. The intensity of dieback on all plots was correlated with yield, giving a very significant coefficient of r = + 0.8253.

Cherry Yields, 1948.—For the third successive year treatment A produced the highest yield, 10.4 cwt. per acre more than B, and 6.7 and 12.1 cwt. of cherry per acre more than C and D. Since the trees were stumped the multiple stem system has yielded 35 to 60 cwt. of cherry per acre more than the other systems of pruning. The single two-stem trees have given 15 and 24 cwt. per acre more than the single-stem trees. The treatments × season interaction is highly significant, as may be seen by the variation in relative yields in each season.

Clean Coffee.—Yields for the past two years are given in Table 4. Differences in the two-year totals are of the same order in clean coffee yields as cherry yields, namely: A > D*** > B** or C**. From two quality samples taken in November the following significant results occur:—

(*a*) Percentage of light coffee. A inferior to B by 20 per cent, A inferior to C and D by 18.5 per cent and 18 per cent respectively.

(*b*) Hulling loss. A inferior to B and D by 4.9 per cent.

(*c*) Cherry/clean coffee ratio. A inferior to B and D by 19.7 per cent.

(*d*) Grade "A and B" percentage. No significance reached although A produced less than the other treatments.

(*e*) Liquoring quality. No difference due to treatment is visible.

In general, therefore, quality and quantity were factors which were inversely related. Even when the lower quality from A is accounted the multiple stem system has given to date a return greatly in excess of the other systems of regeneration.

Crop Reduction Trial

During the second year of the trial records were obtained of dieback branches, scores for recovery and cherry yields. No additional treatments were imposed upon those employed in August, 1947, when the following methods of crop reduction were tried:—

A—All crop removed.

B—Half the crop removed, at the terminal end of each primary.

C—Half the crop removed, at the base end of each primary.

D—Lower bearing primaries removed to leave half the crop.

Scores for Recovery.—A score assigned to all treated trees on 30th April, 1948, proves only the quicker recovery from treatment A.

Dieback Branches.—As in 1947 no significant variation occurred.

Cherry Yields.—Table 6 shows the yields for two years from this trial. The benefit of total stripping is to be seen in an increase in yield the following year of over 250 per cent more than the other treatments. This conclusion is not supported by correlation of weight of green cherry stripped and weight of red cherry borne the following year, which gives a coefficient of $r = +0.2218$ (not significant). Conversely correlation of the weights of red cherry borne in the two seasons gives $r = +0.6620$ and confirms the results stated above.

A practical though limited conclusion may be drawn from the results of this trial: on multiple-stem trees which overbear the lower primaries may be pruned off in order to reduce the crop. The method is quicker and less laborious than removal by hand without being less effective, in spite of the further reduction of total leaf which it involves.

Other Field Trials

A trial containing 21 selections and two shade-tree trials were maintained for future recording. As shade trees become effective observations on one of the latter trials will begin in the coming year. The trees of the selection trial will not be sufficiently mature for crop recording until 1950.

Manurial Trial.—A proportion of the field work was undertaken by the writer, including the full season's crop recording.

Cultivation Experiment.—Treatments were continued for the second year. A note on the practical aspects of the cultivations in the trial is included in the Agricultural Chemist's (Coffee Services) annual report, where full details of the results obtained from both trials may be found.

Variety Trials—Anmer Estate, Kiambu

Variety Trial I

A trial containing eight selections was planted in November, 1942, with the object of studying the relative merits of progeny of the first generation of eight of the most promising trees found in a widespread scheme of individual tree recording which was undertaken in the years before the war.

The Layout.—Single blocks of twenty trees comprise a plot and single lines of ten control trees separate plots. All controls are of the French Mission green-tipped type. Yield recording started in 1945 when only a light crop was picked. Since 1946 the yield of six random trees per selection and twelve random control trees has been recorded. In 1948 the number of control trees was increased to twenty-four. The layout does not allow absolute comparison between selections which are not adjacent. Until several more seasons' records become available the range of comparison is limited to adjacent plots which are not subject to varying adherent effects such as differences in soil fertility. In Table 7 cherry and clean coffee yields from the trial are shown.

Variety Trial II

A similar trial containing ten selections was planted in May, 1945. Eight trees of each selection were marked at random for recording. Thirty-two of the control trees, all of which are the selection S.L. 28, were similarly marked, for comparison with the adjacent selections. The mean yields picked are shown in Table 8. Only S.L. 10 gave a weight of cherry which exceeded that of the adjacent control, whereas M. 83, M. 65 and KIT. 37 yielded less than their controls. The general level of yields was low and of little comparative value.

Karimani Estate, Thika

A small quantity of selected seed was obtained before the sub-station was closed on 30th November.

North Kitito Estate, Makuyu

A trial including 20 selections and varieties was maintained. It is proposed to begin crop recording in 1949.

Kentmere Estate, Upper Kiambu

The yields of 70 individual trees were recorded for cherry and clean coffee weights. Some good yields were produced but in liquoring quality the samples were invariably poor. A review of yields and quality has revealed several trees of outstanding performance; clonal material was obtained from these for further investigation.

We are indebted to the Kenya Tea Company for allowing this work to continue for several years beyond the agreed duration of the lease; consequently it has been possible to complete individual tree recording in a year in which typical climatic conditions prevailed. The sub-station was closed in September.

Kitale Experimental Station

Cherry yields have been taken for a number of years from four replicated trials and analysis of the crop weights produces sufficient evidence from which some conclusive results may be extracted.

Mulching Trial

The trees in this trial were planted in 1938; treatments and cherry yield records have continued since 1942. The treatments are:—

A—Mulch between the rows.

B—Mulch under the trees.

C—Complete cover of mulch.

D—Control—no mulch.

Maize trash has been applied in January each year after deep forking. Cherry yields from these treatments are shown in Table 9.

The only significant difference appearing in treatment totals is that between A and the other treatments. If, as it appears, a mulch laid between the rows of trees has stimulated a higher yield the inferiority of treatment C requires some explanation. The layer of mulch which was applied every year was over nine inches thick; it is likely that this amount as a complete mulch has proved in excess of the optimum, resulting in a depressing effect on yield except after a dry season.

The treatments × seasons interaction is very highly significant indicating the response to treatments was influenced largely by seasonal trends. The effects on yield due to treatments in 1944 are in contrast to those in 1947.

The relation of rainfall in the two years to the crop produced by treatments C and D is thus:—

	1943–44	1946–47
Rainfall: October to April	7·81″	21·32″
Main flowering	May	April
Subsequent crop Cwt. per acre: Treatment C	52·36	33·12
Subsequent crop Cwt. per acre: Treatment D	25·47	43·37

In effect the thick and complete cover of mulch led to a yield double that of control when a dry season preceded flowering. Whereas the treatment depressed yields by ten hundredweights of cherry per acre when flowering followed a wet season.

It is obvious that mulch laid between the trees has given a consistent return amounting to a net gain of 20 to 30 cwt. of cherry per acre.

Manurial Trial

Records of five years are available since the trial was laid down in 1944. The following treatments have been applied every year:—

A—Lupins.

B—Lupins + compost + phosphates.

C—Lupins + compost.

D—Lupins + phosphates.

E—Compost + phosphates.

Lupin seed was drilled in rows at the onset of the rains. In August the lupins were pulled and laid beneath the trees. Compost was applied at the rate of five tons per acre before the rains. Phosphate was given in the form of Seychelles Guano, at 400 lb. per acre.

Table 10 shows the mean weight of cherry recorded from treatments every year. The treatment × seasons interaction is not significant and it is evident

from the table that no treatment group was independent of the effects of seasonal influence. Some significant differences appear within seasons however, viz.:—

1945—D was greater than A, C or E.

1947—A, B and C were superior to D or E.

A small but consistent yearly gain from the use of lupins gave rise to a significant difference of 12 cwt. per acre between treatments B and E. Otherwise no regular response to one or a combination of treatments is visible.

Size of Planting Holes Trial

The crop yields from 60 individual trees of each treatment have been weighed since 1941. At the time of planting in 1938 the sizes of holes were:—

A—1 ft. × 1 ft.

B—1½ ft. × 1½ ft.

C—2 ft. × 2 ft.

D—2½ ft. × 2½ ft.

E—3 ft. × 3 ft.

Yields for eight years are shown in Table 11.

A high degree of variability within treatments has tended to mask differences arising due to the size of the initial planting hole. No consistent response to treatments is apparent and over the eight-year period of trial two treatments only show a real difference in yield. In the eight-year totals, A and B appear lower than the rest. A comparison of the means of the two groups is shown in Table 12. From the latter a mean increase over eight years of 16 cwt. of cherry per acre illustrates the benefit which has been derived from the use of the larger planting holes.

Pruning Trial

Seedlings of the variety Blue Mountain were planted for this trial during 1938. The treatments which have been applied since 1942 are:—

A—Single stem, primaries reduced to 15.

B—Single stem, primaries reduced to 20.

C—Single stem, primaries reduced to 25.

D—Single stem, primaries unreduced.

E—Multiple stem.

Crop yields for seven years are recorded in Table 13.

The treatments × seasons interaction was exceptionally high and a study of individual seasons indicates that there was great variation in the relative yields from treatment groups. The results are conclusive in that single stem pruning yielded over 20 per cent more cherry than multiple stem, except when the number of primaries was severely reduced.

Kapretwa Estate, Mount Elgon

Pruning Trial

The layout and principles of this trial were similar to that at Kitale, although the treatments were not identical, being:—

A—Single stem, primaries reduced to 15.

B—Single stem, primaries reduced to 20.

C—Single stem, primaries reduced to 25.

D—Multiple stem.

E—Single stem, Kapretwa system.

Records of six years appear in Table 14.

All treatments were overbearing in 1944 and an outbreak of Coffee Thrips followed early in 1945.

The differences in total yields which are significant are:—

Treatment E less than the others.

Treatment D more than A or C.

The treatments × seasons interaction was very high, and as the table shows the variation between treatments from season to season was marked.

It should be noted that the pruning system of treatment E was not a true imitation of that in general use on Kapretwa Estate. The amount of bearing wood removed was always much in excess of the estate practice. It is also to be noted that there is no shade tree canopy over the area of the trial, whereas it has been proved that in the absence of shade conditions are often unfavourable for coffee on Mount Elgon. In view of these two irregularities, the results obtained and conclusions therefrom are not necessarily representative of the area as a whole.

The Preservation and Feeding of Coffee Pulp

Recent work in South America has led to the conclusion that fresh and dried coffee pulp is a suitable substitute for corn in the feeding of livestock. In view of the serious shortage of cereals for animal feeding in Kenya it was desirable that some preliminary trials should be conducted during the picking season; but in the prevailing circumstances investigations had to be limited to those of a brief and simple nature.

Two methods of preservation were attempted: by sun-drying and ensiling. Fresh and preserved pulp was fed to Boran cows in a number of ways with results which are summarized very briefly below. Wet pulp can be dried quickly on coffee trays and barbecues in dry weather. Some simple method of ensiling has obvious practical advantages over sun-drying however. In early November pulp was ensiled in small tower silos by six methods, these were:—

$$\left.\begin{array}{l}\text{Coffee pulp} \pm \text{Napier grass hay or} \\ \qquad\qquad \pm \text{Rhodes grass hay}\end{array}\right\} \pm \text{molasses}$$

It was encouraging to discover that pulp alone formed the most satisfactory acid silage, and, with the addition of a small quantity of molasses wastage could be reduced. The following observations were recorded on the palatability of fresh and processed pulp when fed to Boran cows:—

Fresh pulp alone—not readily eaten.

Sun-dried pulp alone—refused.

Ensiled pulp alone—not readily eaten.

Fresh pulp + molasses—fair palatability.

Sun-dried pulp + molasses—fair palatability.

Ensiled pulp + molasses—fair palatability.

Fresh pulp + molasses + equal weight of cake and bran—palatability good.

Sun-dried pulp + molasses + equal weight of cake and bran—palatability fair.

Ensiled pulp + molasses + equal weight of cake and bran—palatability good.

All pulp was fed in its original state, but it is considered that ground pulp would probably be more readily accepted. When the proportion of ensilage to cake and bran was increased a corresponding drop in palatability was noted.

Further investigations will be needed. including digestibility trials and feeding trials over a protracted period, before the use of coffee pulp can be recommended.

The Dairy Herd—Coffee Research Station

The Boran dairy herd of 20 milch cows and followers was maintained throughout the year on natural grazing and supplementary foods, i.e. hay, napier fodder, stock melon and concentrates. The production of milk for the year is shown below in comparison with the previous two years:—

		1948	1947	1946
Average yield in lb. per lactation day	1st Quarter ..	6·91	9·71	9·43
	2nd „ ..	6·77	7·38	8·26
	3rd „ ..	6·73	8·53	9·27
	4th „ ..	7·85	8·53	11·11
	Mean Total	7·05	8·77	9·55
Annual Total in lb. ..		35,630	35,117	33,745

The herd was moved from the Scott Agricultural Laboratories in August, 1946. The recession in average yield which appears in 1948 is an indication of the drought conditions experienced for most of the year. The first of a series of seven Rhodes grass leys was planted in April. With an augmented grass production, more hay and ensilage from fodder crops it will be possible to keep the herd on a higher plane of nutrition where milk production will be less dependent upon rainfall and weather conditions generally.

P. A. JONES,
Agricultural Officer (Coffee Services).

TABLE I

SPRAY TRIAL I—COFFEE RESEARCH STATION

Summary of Results

Year	FACTOR	Linear Responses	Curvatures	Linear Interaction	Significant Differences
1947	Leaf-fall: Total Scores	C* R***	R**	CR*	$C_1 > C_3$* $R_0 > R_1$*** $> R_2$**
	Die-back count	R*	Nil	Nil	$R_0 > R_1$* and R_2*
	Yield of cherry	Nil	Nil	CR*	Nil
1948	Leaf-fall: Total Scores	C* R***	R***	Nil	C_2 and $C_3 > C_1$* $R_0 > R_1$*** and R_2***
	Die-back counts	Nil	Nil	TR*	Nil
	Yield of cherry	R***	R**	Nil	$C_2 > C_1$* $R_2 > R_1$* $> R_0$***
	Clean coffee: per cent Grade "A" and "B"	R***	Nil	Nil	$R_0 > R_1$** and R_2***
	Clean coffee: per cent hulling loss	R***	Nil	Nil	$C_2 > C_1$* R_1 and $R_2 > R_0$**
	Clean coffee/cherry ratio	R***	Nil	Nil	$R_1 > R_0$** $R_2 > R_0$***
	Clean coffee: liquoring Score	T*	T**	Nil	$T_3 > T_1$* and T_2***
1947–48	Cherry yield: two years	R***	R*	Nil	R_2 and $R_1 > R_0$***

* Indicates significance to the 5 % point.

** „ „ „ 1 % „

*** „ „ „ 0·1 % „

TABLE 2
SPRAY TRIAL I—COFFEE RESEARCH STATION
Yield of Cherry in Cwt. per acre

	1947	1948	Total
T_1	33·86	26·07	59·93
T_2	34·05	29·97	64·02
T_3	29·91	29·71	59·62
C_1	33·50	25·37	58·87
C_2	33·08	32·03	65·11
C_3	31·22	28·36	59·58
R_0	31·01	12·86	43·87
R_1	32·83	33·67	66·50
R_2	33·98	39·22	73·20

TABLE 3
SPRAY TRIAL II—COFFEE RESEARCH STATION
Summary of Results

Factor	Treatments				Significant Differences	
	A	B	C	D	5%	1%
Leaf Fall:						
Mean Score per plot	65·2	70·2	66·5	67·8	6·82	—
Die-Back:						
Mean count per plot	332·4	325·2	298·9	432·2	98·6	133
Cherry Yield:						
Cwt. per acre ..	14·07	14·22	11·66	15·71	3·55	—

TABLE 4
PRUNING TRIAL—COFFEE RESEARCH STATION—CLEAN COFFEE AND CHERRY YIELDS

Mean Yield	Treatments				Significant Differences		
	A	B	C	D	5%	1%	0·1%
Clean Coffee:							
Cwt. per acre 1947	13·55	6·15	5·84	10·01	1·431	1·979	2·736
Cwt. per acre 1948	2·045	0·976	1·430	0·719	0·729	1·008	1·394
Fresh Cherry:							
Cwt. per acre 1946	14·79	10·16	3·70	13·41	2·414	3·339	4·614
Cwt. per acre 1947	88·35	53·31	47·18	67·55	6·036	8·128	10·778
Cwt. per acre 1948	17·06	6·67	10·39	4·92	6·036	8·128	10·778
Total 3 years	120·18	70·13	61·27	85·86	15·716	21·734	30·039

TABLE 5
PRUNING TRIAL—COFFEE RESEARCH STATION—DIE-BACK COUNTS

Mean Score	Treatments				Significant Differences		
	A	B	C	D	5%	1%	0·1%
Per plot 1947 ..	158·16	122·00	63·17	197·83	54·45	75·30	104·07
Per plot 1948 ..	193·66	32·00	81·16	69·66	102·67	142·01	196·34

TABLE 6
CROP REDUCTION TRIAL—COFFEE RESEARCH STATION—CHERRY YIELDS

Mean	Treatments				Significant Differences		
	A	B	C	D	5%	1%	0·1%
Yield of Cherry:							
Cwt. per acre 1948	31·34	8·714	9·103	8·522	14·740	22·333	—
Cwt. per acre total 1947–48 ..	31·34	64·56	73·17	89·10	14·060	21·296	34·226

TABLE 7

VARIETY TRIAL I—ANMER ESTATE

Selection	S.L. 3	S.L. 9	S.L. 14	S.L. 17	S.L. 28	S.L. 30	S.L. 34	Kenya Selected	Control
Cherry Yield:									
1946—Mean per tree, lb.	22·12*	18·27	17·07**	15·17	13·13	20·63	18·95	16·55	15·03
1947—Mean per tree, lb.	3·80	10·63	15·28*	16·70*	14·65*	8·23	5·98	8·87	3·31
1948—Mean per tree, lb.	6·50	13·78*	10·63	12·55	10·62	7·72	12·88	10·27	8·45
3 years' mean yield per tree, lb. ..	32·42	42·68**	42·98*	44·42*	38·38	35·56	37·82	35·68*	28·79
Clean Coffee Yield:									
3 years' total as cwt. per acre ..	7·80	15·56	13·28	11·89	16·93	20·93	17·35	14·65	8·91
Score for liquor, total 3 years' ..	46⅔	58⅓	48⅓	57	55⅔	49⅓	55	52	49⅔

TABLE 8

VARIETY TRIAL II—ANMER ESTATE

Selection	S.L. 10	S.L. 33	KIT251	M. 83	KIT61	KIT145	M. 65	KIT85	KIT 37	M. 6	Control
Cherry Yield:											
1948—Mean per tree, lb.	6·80**	1·32	1·05	0·96*	1·77	1·58	0·36*	0·84	—1·39*	1·0	2·06
Clean Coffee Yield:											
As lb. per acre	114·5	33·0	62·5	43·7	130·3	50·2	19·1	91·2	73·8	101·5	32·1

* Indicates significance at the 5 % point.
** ,, ,, ,, 1 % ,,
*** ,, ,, ,, 0.1 % ,,

TABLE 9

MULCHING TRIAL—KITALE STATION

Cherry Yields in Cwt. per Acre

Year	Treatments				Significant Differences		
	A	B	C	D	5%	1%	0·1%
1942	30·59	28·78	30·98	28·59	6·55	8·69	11·35
1943	32·82	32·05	23·28	28·51	6·55	8·69	11·35
1944	41·90	42·44	52·36	25·47	6·55	8·69	11·35
1945	15·30	15·30	12·26	14·88	4·88	6·76	9·34
1946	13·74	12·02	15·10	8·61	3·96	5·48	7·57
1947	42·63	38·30	33·12	43·37	6·21	8·58	11·86
1948	28·04	16·03	16·44	23·46	5·68	7·86	10·86
Total 7 years ..	205·02	184·92	183·54	172·89	19·82	27·42	—

TABLE 10

MANURIAL TRIAL—KITALE STATION

Cherry Yields in Cwt. per Acre

Year	Treatments					Significant Differences		
	A	B	C	D	E	5%	1%	0·1%
1944	6·217	7·484	7·138	6·931	6·100	4·187	—	—
1945	27·408	29·188	28·666	33·076	25·310	4·251	5·673	7·458
1946	6·723	6·451	6·712	6·765	5·588	3·740	—	—
1947	55·843	57·883	56·884	51·334	51·445	4·251	5·673	7·458
1948	13·126	14·612	11·810	12·450	14·736	3·228	—	—
Total 5 years ..	109·317	115·618	111·210	110·556	103·179	10·676	15·097	—

TABLE 11

SIZE OF PLANTING HOLES TRIAL—KITALE STATION

Cherry Yields in Cwt. per Acre

Year	Treatments					Significant Differences	
	A	B	C	D	E	5%	1%
1941	10·244	11·811	16·086	13·841	18·395	4·651	8·519
1942	26·770	27·641	27·457	30·294	29·072	5·178	6·806
1943	15·487	15·151	18·755	18·931	15·055	4·900	—
1944	44·710	42·536	39·508	44·838	47·986	5·178	6·806
1945	8·311	7·863	9·206	7·360	7·871	2·464	—
1946	25·979	25·907	26·155	28·632	28·081	2·925	—
1947	52·709	49·537	58·287	50·040	55·810	5·178	6·806
1948	25·420	19·842	23·430	23·925	24·756	5·178	6·806
Total 8 years ..	209·630	200·288	218·884	217·861	227·026	23·174	—

TABLE 12

Size of Planting Holes Trial—Kitale Station

Cherry Yields in Cwt. per Acre

Year	Treatment	Means	Mean Difference	Significant Differences	
	A+B	C+D+E		5%	1%
1941	11·028	16·107	5·079**	3·346	4·398
1942	27·206	28·940	1·734	3·346	4·398
1943	15·319	17·580	2·261	3·346	4·398
1944	43·624	44·111	0·487	3·346	4·398
1945	8·087	8·145	0·058	3·346	4·398
1946	25·943	27·622	1·679	3·346	4·398
1947	51·123	54·713	3·590*	3·346	4·398
1948	22·631	24·037	1·406	3·346	4·398
Mean of Total 8 years' ..	204·961	221·255	16·294*	14·996	20·029

* Indicates significance at the 5% point.

** „ „ „ 1% „

TABLE 13

Pruning Trial—Kitale Station

Cherry Yield in Cwt. per Acre

Year	Treatments					Significant Differences		
	A	B	C	D	E	5%	1%	0·1%
1942..	21·558	32·951	22·900	51·351	41·108	10·848	14·384	18·459
1943..	14·282	15·678	18·627	11·016	14·348	5·951	8·379	11·843
1944..	19·934	24·267	26·580	35·289	25·430	10·848	14·384	18·459
1945..	25·843	30·338	35·163	21·989	18·064	10·848	14·384	18·459
1946..	25·472	30·764	27·060	39·909	15·996	10·848	14·384	18·459
1947..	52·927	66·028	79·645	52·591	47·964	10·848	14·384	18·459
1948..	16·721	17·177	13·749	20·455	18·843	4·777	6·724	9·508
Total 7 years ..	176·737	217·203	223 724	232·606	181·753	33·047	46·526	65·759

TABLE 14

Pruning Trial—Kapretwa Estate

Cherry Yield in Cwt. per Acre

Year	Treatments					Significant Differences		
	A	B	C	D	E	5%	1%	0·1%
1942..	49·50	55·14	53·22	76·71	44·77	6·64	9·16	12·57
1943..	26·62	28·25	14·12	20·89	15·07	8·59	11·39	14·50
1944..	71·99	79·19	89·47	93·29	56·10	8·59	11·39	14·50
1945..	5·56	6·66	3·37	14·42	9·30	8·59	11·39	14·50
1946..	17·79	23·09	20·44	14·07	16·64	7·02	9·67	13·29
1947..	59·36	58·30	60·90	30·74	55·87	8·59	11·39	14·50
1948..	4·26	3·81	3·84	26·71	4·03	5·92	8·16	11·21
Total 7 years	235·08	254·44	245·36	276·83	201·78	28·91	40·18	55·53

ANNUAL REPORT OF THE PLANT PHYSIOLOGIST AND PATHOLOGIST, COFFEE SERVICES, 1948

General

I continued to act as Senior Plant Pathologist until the return of Dr. R. M. Nattrass towards the end of February, and my activities in this connexion practically precluded further investigations on coffee physiology. In July I proceeded on overseas leave, but in the interval it was possible to set up certain experiments on copper spraying and leaf fall which have produced important results. The growth and flowering observational block of coffee continued to be recorded through the year and a further series of plaster of paris blocks was installed for soil moisture measurement. I attended meetings of an East African soil discussion group in Nairobi in April and those of the Interterritorial Conference on Plant Protection in June. An exhibit on the distribution of coffee roots in relation to methods of cultivation was staged at the "Country Comes to Town" Exhibition in January.

An article "Spraying Against Leaf Rust in East of the Rift Coffee Areas" was published in the *Coffee Board Bulletin* in January and was followed up by an article on "Tonic Copper Spraying" written in collaboration with the Agricultural Officer, Coffee Services, in February. A letter on "Latent Infection in *Coffea arabica* L" was published in February in *Nature*. In March a talk, "The Growth of the Coffee Tree in Relation to Climate", was given to the Veterinary Laboratory Scientific Society.

During my visit to England I spent six weeks visiting various research institutions investigating physiological research methods being used and discussing specific coffee physiological problems.

Leaf Fall and Copper Sprays

Copper-containing sprays have long been used by coffee planters to reduce leaf fall and to increase yield. As they were still effective when leaf rust was not present and in the absence of any apparent fungal disease they were considered to be effective, not because of their fungicidal properties but due to some action on the metabolism of the plant. As this appeared to be in the nature of a stimulation to increased activity and better health, the term "tonic sprays" was employed.

As cuprous oxide sprays had been found equally effective by the coffee research station at Lyamungu, a result which has recently been confirmed in Kenya, the copper ion was considered the active part of the spray. This suggested the possibility of the action being due to a copper deficiency and led Dr. Pereira to test this hypothesis by examining the effect of copper injection on leaf fall with negative results.*

During certain investigations carried out in connexion with coffee berry disease (*Colletotrichum coffeanum* Noack) some time ago†, it was found that forms of this same fungus were abundantly present in all superficial living tissues of coffee and might be responsible for the yellow or "weak" spotting of mature coffee leaves usually so noticeable at the time of maximum leaf fall. It was considered that there might be some relation between this type of infection and leaf fall and that the question of whether the copper sprays were active due to their fungicidal properties or to their contained copper should be carefully examined.

Accordingly, in co-operation with Dr. Pereira, an experiment of statistical design was laid down at the Scott Agricultural Laboratories in which the effect of non-copper-containing fungicidal sprays on leaf fall and yield was com-

*Annual Report, 1948.

†Annual Report, 1941.

pared with those of copper sprays and copper injection. Six treatments were used: burgundy (Magadi ash) mixture, carbide bordeaux, lime sulphur, tulisan (an organic fungicide), copper injection and no spray. The copper sprays were applied at the rate of one pint per tree at a 2 per cent concentration, this being a tonic spray rate. The lime sulphur (Capex) was 1 in 60 and the tulisan 2 oz. to the gallon and they were applied at the rate of half a gallon per tree, i.e. at normal fungicidal rates and concentrations. The sprays were applied to single tree plots using calico shields to prevent spray drift. There were 72 trees in all, 12 trees per treatment arranged in a 6 by 6 Latin square and six randomized blocks. The material was S.L. 28 single-stem grafts on French Mission root stocks. Spraying was carried out on 27th and 28th May, about the middle of the long rains growth period, and again on 1st July when it was practically over. The injection treatment was carried out on 8th June, each tree being given the precipitated basic copper from one pint of 2 per cent bordeaux. Previous to the experiment, an early crop which would have matured about July and which would have caused considerable die-back was completely stripped in April. In May the trees were pruned and the crop thinned to three to four cherries per node owing to the danger of overbearing and consequent leaf loss.

The ground was cleared under the trees and counts made of the number of fallen leaves at twice-weekly intervals starting in June. The yield of the individual trees was also recorded.

Total leaf falls up to the February pruning and the total yields have been statistically analysed. Leaf fall was markedly less for all four spray treatments, amounting on an average to a 36 per cent reduction over the control and injected trees. This was very highly significant. There was no significant difference between any of the four spray treatments, nor between the control and the injection treatment. There were no significant differences between the yields for the various treatments, though there was a strong and consistent suggestion that burgundy was better than bordeaux. The variability of individual trees was, however, very high. It must also be remembered that crop control had been very carefully carried out so as not to mask normal leaf fall by overbearing effects and marked effects on yield had not been anticipated.

Graphs for the march of leaf-fall rate with time showed that after mid-July there were consistently lower rates for all the spray treatments until pruning was performed in February. There is a suggestion that the effect of the sprays was beginning to decrease at this time. There was also a suggestion that both copper sprays increased the leaf-fall rate in the first month following spraying, whereas the non-copper fungicides did not affect it at this time.

The effects on leaf fall by the non-copper containing fungicides are very striking and are very strong evidence that copper sprays are acting through their fungicidal properties and not as a tonic as hitherto supposed. It remains to be investigated whether this is due to their action on the *Colletotrichum coffeanum* latent infections.

It should be emphasized that the results of this experiment in no way suggest that there are better sprays for controlling leaf fall than the copper sprays already in use. They do, however, indicate the need for further investigation of the time of application in the light of their apparent fungicidal nature and of rates of application, especially as recent field trial results suggest increasing leaf-fall control from increasing rates.

In addition to the above tree-spraying trial, two further experiments were set up using individual leaf and branch spraying. In the first it was hoped to determine the effects of age of leaf at spraying and date of formation on length of leaf life. Individual leaves were marked for month of formation and sprayed after one to six months with burgundy mixture. The experiment had to be abandoned in October as Mrs. Brown, who was carrying it out, had to leave suddenly

for South Africa. Up to that date there had apparently been no differential effect as between sprayed and unsprayed leaves. The experiment was found to be very time consuming and if it is to be repeated will have to be redesigned.

The branch-spraying experiment was set up in order to see whether the spraying of young leaves would affect the length of life of old leaves on the same branch. Ten multiple-stem trees were chosen and all branches marked at the beginning of March with indian ink above the last pair of opened leaves. On 3rd March 20 branches were sprayed and 10 marked as controls. In the middle of each subsequent month 20 further branches were sprayed on the leaves formed after the 3rd March only. Observations were made on the shedding of the leaves formed before 3rd March on all branches. By mid-October, when the experiment had to be abandoned for the same reason as the last, the branches which had had the old leaves sprayed still retained 34.7 per cent of the leaves present at the beginning of the experiment, while the controls only retained 5.9 per cent. The fall of leaf formed before March from the branches on which young leaves only were sprayed was not significantly different from that on the controls, though there was a suggestion that it was slightly less in the case of spraying in April, becoming progressively more for branches sprayed in later months. Thus if there is any effect on the shedding of older leaves by the spraying of young leaves it is very small and certainly would have no practical significance.

The curves for percentage of total leaf surviving at monthly intervals were sigmoid in form with the point of inflection later and the curve more gradual in the case of the sprayed branches. The distance between the points of inflection gives an estimate of average increase in length of leaf life due to spraying as about nine weeks. In the control the point of inflection occurred at the end of July. The leaves recorded represented pre-March growth and were probably mainly formed in October from which may be deduced that they had an average life of 9½ months. Thus, by spraying when they are fully mature in March, their life can be lengthened to nearly 12 months.

Lightning Damage

Two interesting cases of lightning damage were observed. In the first, on Kethekai Estate, Machakos, some 100 multiple stem trees were affected and were typical of the usual form of damage. The first symptoms were visible about ten days after a bad thunderstorm had passed over the area, and ranged from the wilting and death of a few scattered upper branches to the almost complete death of the tree. Although trees with more severe symptoms occurred near the centre of the area there was very considerable variation in the severity of the symptoms shown by neighbouring trees. The cambium and adjacent tissues of wilted branches were brown and, whereas in mild cases this could be traced down the branch for only a foot or so, in badly affected trees, the cambium of the trunk was brown almost to ground level, but this could never be traced downwards into the roots which always appeared healthy. Individual trees are never struck in this form of damage and it is thought that a discharge of electricity occurs from the tips of the bushes so producing a current through the cambium of the branches. This current is naturally most intense towards the tips of the branches where the conducting path is narrowest and becomes less intense as the conducting path becomes wider passing downwards and hence does less damage until it reaches ground level where it is widely spread and does no damage at all.

The second type of lightning damage was observed on Karura Estate, Kiambu, where a shade tree had been struck. The coffee trees around for two or three rows were dying back, those nearest the shade tree being the worst affected. The cambium of the trunk and branches was unaffected, but that of the roots right up to the collar of the trees was brown and presumably dead, the exact reverse of the symptoms described above. This type of damage agrees

with symptoms recorded for tea in Ceylon and is believed to be due to the electric current which passes through the ground at the time the shade tree is struck, killing the roots of the tea.

Growth Observations at the Scott Agricultural Laboratories

The observations have not been completely tabulated yet, but there appears to have been a marked but rather short maximum growth period in the long rains followed by a well-marked lesser period in the short rains. Plaster of paris resistance blocks were installed in two further profiles in the recorded coffee, in one case down to a depth of 15 ft. An inspection of the readings obtained suggests that they will provide valuable information on the relation between growth and soil moisture.

Official Visits in England

About six weeks were spent in visiting various laboratories, etc., in England. The following is a list of the principal places visited, together with an outline of some of the subjects discussed:—

The Commonwealth Mycological Bureau.—General problems of colonial pathologists, with especial reference to Kenya, were discussed with the staff and advice and help sought in dealing with the systematics of the coffee latent infection fungi. Notes were made on a number of techniques used by the Bureau.

Cambridge University Botany School.—Coffee pathological problems were discussed with Professor Brooks and Dr. Dowson, physiological problems with Professor Briggs, Dr. Maskell and Dr. Evans, and biochemical problems with Dr. Hanes. Research being performed by a number of research workers was studied.

Pest Control, Ltd., Harston.—A visit was paid to this organization and its methods studied.

Plant Protection, Ltd.—The experimental farm was visited.

Imperial College, University of London.—The Plant Physiological Research Institute was visited and its work discussed with Professor Gregory and Dr. Heath. Research work in progress was studied. The discoveries made by Dr. Heath and his students on the sensitivity of stomata to carbon dioxide concentration will have important repercussions on the methods used in future investigations of photosynthesis in coffee.

A meeting of the Society for Experimental Biologists was attended.

Jealotts Hill and Hawthorndale Research Stations.—The work of these stations was studied. Problems of "tonic copper" spraying in coffee were discussed with Dr. Tippler.

Rothamsted Experimental Station.—The methods of growth analysis and the possibilities of employing the technique with coffee were discussed with Dr. Watson and Dr. Humphries described his present work on the problem of assessing the "activity of roots". Dr. Schofield outlined his present attack on the problem of phosphate availability from the energetic point of view and discussed the recent investigations on soil moisture and evaporation from soil and plant surfaces undertaken in his laboratory. The Imperial College plant physiology laboratory at Rothamsted was visited and the research work in progress studied. Dr. Porter was considerably interested in the phenomenon of carbohydrate die-back in coffee and a valuable discussion ensued. Dr. Richards demonstrated his technique for investigating amino-acids in plant tissues by the use of paper chromatography.

East Malling Research Station.—Problems of flower bud differentiation, assimilation measurement and nutritional differentiation of roots were discussed with Dr. Vyvyan. Dr. Barlow described his work on plant hormones and leaf fall. Soil moisture measurement was discussed with Dr. Rogers, and Dr. Roach discussed methods of investigating the possibility of copper deficiency being the reason for the supposed "tonic" effect of copper sprays on coffee.

Nottingham University School of Agriculture.—Problems of environment control chamber construction were discussed with Dr. Wilson.

Pasture Research Station, Stratford on Avon.—Dr. Williams' work on grass nutrition and flower bud differentiation was studied and soil moisture measurement methods discussed.

University of Reading.—The work of the plant physiological section was discussed with Dr. Hora and Dr. Steele. Professor Stoughton's help was sought in regard to the construction of environment control chambers.

Long Ashton Horticultural Research Station.—Dr. Luckwill outlined his work on plant hormones, Dr. Hewitt demonstrated sand culture work on plant nutrition and Dr. Nicholas explained the Aspergillus niger bioassay method for both major and minor nutrients which he was employing.

The Atomic Energy Research Establishment, Harwell.—Dr. Boursnell of the Cambridge Biochemistry School and Professor Wormall of the Medical School of St. Bartholomew's Hospital had very kindly explained to me the methods they employed in biochemical and medical research using radioactive tracers and I discussed the application of the technique to plant physiology with Dr. Thomas at Long Ashton and Dr. Scott Russell of the School of Agriculture, Oxford University. I went into the possibilities of using radioautograph technique quantitatively with Dr. Pelc of Hammersmith Hospital. At Harwell I discussed questions of Geiger counter supply and design with Dr. Taylor and facilities for obtaining radioactive tracers with the Isotope Division.

As an outcome of my investigations I have now a clear picture of the possibilities of using the technique in East Africa. Although equipment would not be excessively costly (about £200), and in the case of certain tracers, in particular Phosphorus 32, materials could be brought out to East Africa relatively easily, the expense and study required would only be justifiable if full-time use of the method were to be made for two or three years employing the normal Geiger-Muller counting techniques. In fact the position is exactly paralleled by the employment of the spectrograph in plant nutritional studies. A solution of the difficulty might be met in a similar way, i.e. by the setting up of a special analytical unit. On the other hand, semi-quantitative radioautograph methods might be applied by individual workers to certain investigations of short duration.

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Plant Physiologist and Pathologist (Coffee Services).

ANNUAL REPORT OF THE AGRICULTURAL CHEMIST, COFFEE SERVICES, 1948

The main lines of investigation reported in 1947 were continued and extended. The main problems studied were the conservation of soil moisture, the changes in the structure of a coffee soil under cultivation, and the nutritional requirements of the coffee crop.

By arrangement between the Department of Agriculture and the East African Agriculture and Forestry Research Organization, Dr. Birch of Amani co-operated in an investigation of the availability of phosphates in deep coffee subsoils, while the writer was able to pay a brief visit to Zanzibar to advise on certain soil moisture experiments. Assistance was also given in soil moisture studies initiated by the Hydrology Section of the Public Works Department, Nairobi.

In addition to the experiments reported below, two sampling techniques for antestia-control trials were designed for the Senior Entomologist (Coffee) and the resulting data were analysed by covariance methods. Nine statistical designs were prepared, and seven sets of field data were analysed, for other officers of the Department.

Soil Moisture Studies

Soil moisture relationships in the deep subsoil and the depths from which the coffee crop obtains its supplies at different times in the season, were studied by digging 10 ft. deep pits, from the walls of which samples were taken by driving in steel volumetric cylinders. Field capacity and pore space determinations were made, and the proportion of the soil moisture available for plant use was studied by the use of sunflower seedlings for the direct determination of wilting range. In making these sunflower observations, cylindrical screened-electrode absorption blocks constructed in the laboratory were incorporated for calibration to the depths of subsoil at which they were later installed. This process is extremely time-consuming, but the quantity of information obtained justifies its use. Mechanical difficulties, accentuated by absence of workshop facilities, have held up the employment of the more rapid compressed-air method.

The effect of grass mulches on soil moisture conservation and on the protection of surface soil structure were studied by soil-sampling on coffee estates and by a replicated field experiment on mulched fallow at the Scott Agricultural Laboratories. In this trial, mulches 2 in. and 4 in. deep were applied, after weeding, at the end of the rains, in June, in December and in both June and December. The mulches are being applied both annually and biennially in order to compare the effects of all row and alternate row mulches. Calibrated absorption blocks for electrical recording of soil moisture have been installed under some of the plots: at times indicated by these block readings, soil moisture sampling is carried out by auger on all plots.

Results to date show that the minimum depth for an effective grass mulch is 4 in. Termites are the main cause of breakdown of the mulches, but they leave a soil surface pierced by some ten or more $\frac{1}{4}$ in. holes to the square foot, a valuable effect contributing both to aeration and the rapid infiltration of rainfall.

Soil moisture samples taken after more than ten weeks of drought on coffee estates at Thika, Ruiru and Kiambu showed a consistently higher moisture content in the first three feet of soil under grass mulches, as compared with bare soil. The samples were taken at mid-rows in alternate-row mulches, four or more pairs, nine feet apart, being taken at each depth on each estate.

Table 1 summarizes the results converted to inches of water in each soil horizon by data obtained from steel volumetric cylinders.

TABLE 1

INCHES OF WATER IN THE FIRST THREE FEET OF SOIL

	Coffee						Fallow		
	Upper Kiambu 6,000 ft.		Mid. Ruiru 5,400 ft.		Lower Thika 5,200 ft.		Kabete 5,700 ft.		
	Grass Mulch	Bare Soil	Grass Mulch	Bare Soil	Grass Mulch	Bare Soil	4" Grass Mulch	2" Grass Mulch	Bare Soil
0–6 in.	1·20	1·11	0·87	0·68	0·81	0·66	1·23	0·90	0·75
6 in.–1 ft.	1·51	1·48	1·20	1·01	1·10	1·04	1·59	1·53	1·54
1ft.–2 ft.	3·19	3·19	2·66	2·54	2·65	2·59	3·32	3·27	3·26
2 ft.–3 ft.	3·45	3·37	3·07	2·79	2·79	2·81	3·61	3·54	3·33
Total water in 3 ft. profile	9·35	9·15	7·80	7·02	7·35	7·10	9·76	9·24	8·88

Nearly all of the water available to the coffee had been used up, even under the mulch, in the three feet sampled. The bare soil, however, was drying well into the wilting range, so that the top foot would require repayment, from the first showers of rain, of from 12 to 38 "points" before the coffee could begin to benefit.

The value of the conservation of 0.88 in. of water under mulch at the end of a severe drought can only be evaluated by its effect on coffee yields. For yield measurements a full scale field trial is required, and this is being undertaken at the Coffee Research Station as a joint experiment with the Agricultural Officer in 1949.

Factors Governing the Evaporation of Soil Moisture.—Measurements of meteorological factors and of soil moisture were continued, in pursuit of a relationship applicable to the very considerable meteorological data available for coffee areas.

A four-foot diameter evaporating pan, kindly lent by the Hydrology Section of the Public Works Department, was installed with the water at ground level, in a pit from which it can be readily removed for detection of leaks.

Radiation, soil surface temperature, evaporation and wind-speed were compared with frequent electrical readings of calibrated absorption blocks under bare and mulched soils.

Development of Screened-electrode Cylindrical Absorption Blocks for Measurement of Soil Moisture.—Sixty of these units were prepared by Mr. Killick in the laboratory. They were first calibrated for weight and resistance by repeated slow drying in chambers of controlled humidity and were then calibrated in the subsoils in which they were to be used in the field.

A study of their ability to measure soil moisture losses under continuous drought will shortly be submitted for publication.

Soil Structure—Sieving Measurements

Measurements of changes in soil structure on the cultivation trial are reported in the next section. Samples were also taken to observe the changes of structure where Napier grass had replaced unthrifty coffee, and the rate of deterioration of this structure when new coffee was planted.

The results for percentages of water-stable aggregates were found to be very variable, in spite of high replication. A study of the technique of wet sieving, and of the considerable literature on the subject, suggested the following improvements:—

(1) *Selection of the sub-sample;* air dried soil was carefully crumbled by hand to pass a 7 mm. sieve. After light shaking in the dry state through a bank

of round-holed sieves, the fractions passing 0.5 mm., and those retained by the 0.5, 1, 2, 3, 4 and 5 mm. sieves were weighed. Sub-samples were then made up by "weighted" contributions from each size fraction.

(2) *The wetting of the air-dried soil*; this is a potent source of variation, the disintegration being caused mainly by trapped air. Wetting by capillarity only partially avoids this trouble. Samples were therefore wetted by a very fine spray of water operated inside a vacuum desiccator, followed by slaking for a minimum of one hour. Very clean samples, without visible signs of disruption, are thus obtained.

(3) *The oscillation of the sieves;* the degree of violence used in manual shaking, or in the application of a jet, is very difficult to standardize effectively, and continuation until the sample appears clean involves a subjective estimate. A mechanical oscillator was therefore devised to raise and lower the nest of sieves under standard conditions through a distance of 7.5 cm. By arranging a quarter-rotation of the sieves on each stroke, the aggregates were washed clean on all occasions.

The results suggest that the very striking improvements in pore-spaces and organic matter which were produced by the Napier grass, were lost very rapidly when the soil was exposed to the sun as a result of clean cultivation of the new coffee seedlings. Continuous cover with a light grass mulch is absolutely essential until the coffee trees themselves can shade the soil.

Cultivation and Weed Control Experiment

The field trial at the Coffee Research Station was continued in 1948 as a joint experiment with the Agricultural Officer (Coffee Services). The field cultivations, crop picking and crop sampling were carried out by Mr. Jones, while the writer undertook soil moisture, pore space, field capacity aggregation and organic matter determinations and the statistical analysis of the data.

Details of Plots.—The treatments were fully described in the 1947 Annual Report. The trial is in 10 ft. by 10 ft. well-grown multi-stem coffee, on undulating slopes. The 81 plots for cultivation treatments are of 40 trees, split into 20-tree sub-plots for testing Athi Plains boma manure and its interactions with cultivations. Subsoiling treatments are as yet incomplete and have been ignored in the analysis of variance. Depths of cultivation were 2 in. to 3 in. for "shallow" and 5 in. to 6 in. for "deep" operations. Weed control contrasts were applied only in the rains, i.e. from March to May (inclusive) and from October to December (inclusive). All plots were cleaned at the beginning of the dry spells in January and June respectively.

Crop Yield Treatment Totals in Pounds of Cherry. (Weighed to ¼-lb. Given to nearest pound).—

TABLE 2

Depth of Cultivation	Implement								
	Hand Jembe			Disc			Plough		
	Clean	Slashed	Weedy	Clean	Slashed	Weedy	Clean	Slashed	Weedy
Shallow	1,251	528	471	852	695	379	825	431	594
Shallow and once deep	1,306	414	477	890	820	355	938	642	429
Deep	1,462	662	266	750	527	615	775	760	270

Standard error ± 56.2 lb. per plot. Coefficient of variation 25 per cent.

Significant differences between yields in the above table:—

At the 5 per cent level of probability .. .. .. 227 lb.

At the 1 per cent level of probability .. .. .. 370 lb.

Implement Effects (Treatment Totals in Pounds of Cherry)—

Jembe	6,836	>	964*
Disc	5,872	>	210 (not significant).
Plough	5,662		

Weed Control Effects (Treatment Totals in Pounds of Cherry)—

Clean	9,047	>	3,568***
Slashed	5,479	>	1,625***
Weedy	3,854		

Depths of Cultivation—

Shallow	2,250	>	53 (not significant)
Shallow plus once deep ..	2,197	>	192 (not significant).
Deep	2,389		

Interactions.—Two of the degrees of freedom for interaction of implements with weed controls were significant. The increases of crop obtained both by clean weeding and by slashing were significantly greater for cultivations done by jembe as compared with mechanical cultivations. There were no significant differences between plough and disc in this respect.

Interpretation.—After two seasons of cultivation and weed control treatments, economically important yield differences were observed. The full growth of weeds during the rains reduced the crop yield by 57 per cent as compared with clean weeding. Slashing the weeds at intervals during the rains gave a significant improvement in yield, but the results were still 39 per cent below those of the clean-weeded plots. The plough and disc showed no differences in yield at any depth or frequency of operation, but hand cultivation gave yields significantly greater than mechanical methods. The significant interaction with the weed-control contrasts points to greater efficiency in weed destruction by the hand treatments, and not to any effect of root-cutting by the plough. Where a full growth of weeds was permitted in the rains, no yield differences were produced by using plough, disc or jembe for the final cleaning twice per year. Results from the manurial trials suggest that the weed competition had probably been for water rather than for nutrients.

It is necessary to emphasize that this implement contrast applies to areas in which the first six inches of soil are dry for much of the year. In higher and wetter areas, where the surface root-mat of coffee is active for longer periods, root-cutting might be expected to have more serious results.

The efficiency of the plough and disc to control weeds was also affected by the equipment deficiencies of the Station, as described in the following note by the Agricultural Officer:—

> "On three occasions incidental rainfall, after the end of the long or short rains, entailed an additional set of cultivations and slashings.
>
> Cultivation implements suitable for the whole range of treatments were not available at the Station, and although every effort was made in the field, the results were not all satisfactory.
>
> *Hand Jembe.*—Weeds were uprooted in an entirely satisfactory manner and a good broken surface was obtained. The weeding was effectively clean, although some weeds rooted in disturbed clods survived for a time.
>
> *Disc Harrow.*—A good result was obtained at both depths when weed cover was light. The heavy tandem disc cut to full depth and gave effective cleaning, but two-way discing would have improved the kill. This heavy disc could not be set to operate effectively at three inches, and a light single-gang ox disc had to be used. Even three runs over the same plots did not produce a satisfactory kill with this most unsuitable implement. The effects are seen in the significant interaction of weed control and implements on yield, the shallow-disced plots being less effectively weeded.

Plough.—A three-furrow towed plough had to be used, although it was most inconvenient for plot work. On the clean-weeded plots it worked well, but in June and December it choked very frequently when turning in tall weeds, especially on the shallow ploughing. This made the depth control practically impossible.

A Ferguson tractor arrived at the close of the year; using rear-mounted plough and discs, with hydraulic lift it should be possible to carry out the contrasting weed-control treatments quickly and effectively during 1949."

Effects of Dry-plains Boma Manure.—A typical consignment of manure supplied to the coffee industry was applied at a rate of one debe per tree. The results from 81 pairs of 20-tree sub-plots were:—

Manure	9,252.50 lb. cherry
Control	9,127.50 lb. cherry
Difference	125.00 lb. cherry

The yield was not affected. The apparent difference of 1.37 per cent, which amounts only to 3 lb. per acre of clean coffee, is negligible, and is well within experimental error.

The analysis of the manure by the Chemistry Section of the Scott Agricultural Laboratories showed that nearly 75 per cent of the manure was earth.

Clean Coffee Ratio.—There were no appreciable treatment effects on clean-coffee ratio, in the one comprehensive sampling which it was possible to undertake, although there was a suggestion that the clean weeding had slightly improved the ratio.

Clean coffee ratios measured on other experiments had shown a marked seasonal variation, about a mean value of approximately ten. Until the station is equipped to undertake the very heavy task of separate preparations for all pickings and treatments, it is perhaps best to report yields in pounds of cherry. The yields were low, since drought had been severe while the crop was filling out. The mean yield of clean coffee was about 2.2 cwt. per acre, while treatment yields varied between 4.7 and 0.9 cwt. per acre.

Effect of the Treatments on the Structure of the Topsoil.—Approximately two hundred samples were taken during dry weather in September and October; 81 steel volumetric cylinder samples from the 0 to 6 in. soil were studied for field capacity and pore space, while separate samples, taken by lifting 3 in. cubes from the soil surface, were sieved for both dry and wet granulation measurements.

The data are far too voluminous for detailed discussion here, and will be fully reported elsewhere. A brief summary of results is given below:—

TABLE 3

	Total Pore Space as per cent Apparent Soil Volume	Field Capacity at 50 cm. tension, as per cent Oven Dry Weight	Field Capacity as per cent Total Soil Volume	Non-Capillary Pore-Space as per cent total Soil Volume
	%	%	%	%
Hand Jembe ..	62·3	44·2	41·4	21·2
Disc	61·3	45·4	43·1	18·5
Plough	61·3	46·3	46·3	15·0

The reduction in the amount of large pore-spaces, which are vital both for aeration and for the acceptance of rainfall, represents serious damage to the structure of the topsoil. The slight increase in field capacity, possibly through the incorporation of powdery semi-decomposed weed residues, can in no way compensate for the loss of structure, since the function of the surface soil is to accept and transmit rainfall, and not to store it where it can be quickly evaporated.

All of the samples taken were found to be well below the wilting point, or edge of the wilting range, which for this topsoil averaged 22 per cent of its oven-dry weight. There was the expected effect of drying out of the disturbed soil, but no differences due to treatments other than depth.

TABLE 4

AGGREGATES AS PERCENTAGES BY WEIGHT OF OVEN-DRY SOIL

(*Means for 81 Soil Samples*)

	Dry Sieving		Wet Sieving	
	All over 0·5 mm.	All over 2 mm.	All over 1·0 mm.	All over 2·0 mm.
	%	%	%	%
Hand Jembe ..	58·1	25·8	32·6	17·8
Disc	63·2	31·8	38·0	24·5
Plough	62·8	28·9	36·0	20·9

The results of sieving of the first three inches of topsoil show very consistent relationships between the proportions of dry and water-stable crumbs.

Deep cultivation appeared to reduce the proportion of large aggregates, while slashing of weeds appeared to increase it, but these trends, although consistent, did not reach statistical significance.

The results for cultivation implements are unexpected, in that the hand-cultivated plots show a lower surface crumb structure than do either disced or ploughed treatments. The difference between hand jembe and disc cultivation reaches the five per cent level of significance: agreement between replicates on the same sample was good, but wide variations were observed between the three samples taken from each plot, and the results are not yet conclusive.

The relations between crumb structure and pore space distribution in this lateritic soil are being further investigated.

Coffe Manurial Trial

The results of two annual applications of the following dressings, to 20-tree plots of single-stemmed coffee in four replications of a 3 by 3 by 3 design, are shown in Table 5 below:—

N
- n_0 No nitrogen.
- n_1 1 cwt. per acre sulphate of ammonia.
- n_2 2 cwt. per acre sulphate of ammonia.

P
- p_0 No phosphate.
- p_1 2 cwt. per acre Sodaphosphate (45 lb. total P_2O_5 of which 7 lb. are citric-soluble).
- p_2 3¼ cwt. per acre Uganda Rock Phosphate (90 lb. total P_2O_5 of which 3½ lb. are citric-soluble).

C
- c_0 No compost.
- c_1 1 debe per tree (3½ tons per acre).
- c_2 2 debbies per tree (7 tons per acre).

Napier Grass bedding from covered yards, composted in outdoor pits.

Where P and C occur together, the phosphates were incorporated during preparation of the compost.

A severe drought from July to October resulted in much yellowing, leaf-fall and dieback. Crop reduction was therefore necessary, and this was carried out on all blocks on the 4th August. The same volume of green cherry was removed from each plot in a replication, but the cherry was taken selectively from the individual trees most in danger of over-cropping.

It had been expected that such adverse conditions would show up the cumulative effects of two seasons' manuring, especially at the higher levels of compost and nitrogen. Yields were more variable than in 1947, but the high degree of replication maintained sufficient accuracy, and a yield increase of 25 lb. of clean coffee per acre would have been detected with confidence. No such increase was produced by any combination of the nitrogen, phosphate or compost, i.e. none of the treatments or interactions were either statistically or economically significant.

The total yields for two years, expressed as percentages of the mean, are given in Table 5.

TABLE 5

n_0	100·2	p_0	99·3	c_0	101·6
n_1	97·3	p_1	100·2	c_1	99·0
n_2	102·6	p_2	100·7	c_2	99·6

These results, together with the soil moisture observations, already described, indicate that crop yields were determined mainly by soil moisture supplies. Yields from the twelve blocks of the experiment were significantly different and were closely related to the depth of sub-soil below the trees. This ranged from six to over fifteen feet, and the capacity of the subsoil reservoir of soil moisture clearly played a greater part than did the nutrient status of the soils.

Die-back Counts.—All died-back wood was counted on the 2,160 trees of the manurial trial and on the 720 trees of a subsidiary nitrogen trial; no effect of fertilizers was observed. The substantial and significant decrease in dieback produced by the sulphate of ammonia in 1947 was not repeated in 1948. The heavy dieback caused by drought during the filling-out of the crop in 1948 was evidently not affected by nitrogen supplies.

Clean Coffee Ratio and Size of Bean.—Two extensive samplings were made, on the third and fifth main-crop pickings. The first sampling, on the 20th October, was in drought conditions. The four replications were pooled, and samples were taken for all 27 treatment combinations. Clean coffee ratio was high and variable, the mean value being 11.9 and the extremes 7.2 to 18.7. No effects of treatments were visible either in clean coffee ratio or in size of beans.

In the second sampling, after useful heavy rain had arrived, only the heaviest-cropping replication was sampled. The 27 treatment combinations showed a mean c.c.r. of 9.21 $\pm$ 0.16. The individual sample results were far less variable on this occasion and the main effects are summarized below:—

TABLE 6

Ratio of Cherry to Clean Coffee Weights

n_0	9·27	p_0	9·73	c_0	9·24
n_1	9·24	p_1	8·73	c_1	9·09
n_2	9·11	p_2	9·17	c_2	9·29

The reduction in this ratio by the sodaphosphate treatment just reaches the five per cent level of statistical significance, but since this effect is opposite to that observed in the previous season, further results must be awaited.

No effects on size of bean were produced.

Quality Factors.—Both sets of 27 samples were liquored by Mr. Devonshire, and the scores for quality and commercial valuations were analysed. There were no significant effects of the fertilizers or compost treatments.

The dominant commercial importance of the appearance of raw and roast led to a study of methods of improvement. The first results appeared to be of commercial importance and were published in the Bulletin of the Coffee Board (Vol. XIV, p. 57). It appears that the mass of fermenting by-products by which the bean is surrounded in the ordinary "dry" fermentation, is both unnecessary and potentially damaging. Coffee fermented under clean water, washed twice daily so that the mucilage was removed as soon as it was free, improved by from one to three classes: the improvements were principally in the brighter appearance of roasts and the avoidance of "foxy" colour in the raws. The results for ten different bulked samples of coffee from the manurial trial are give in Table 7:—

TABLE 7

Number	Classification			Improvement in Value per ton
	Bulk Sample	Washed Sub-sample	Difference	
				£
1	5	3	2	14
2	5	3	2	14
3	5	5	0	—
4	5	3	2	14
5	6	3	3	20
6	5	3	2	14
7	5	3	2	14
8	5	4	1	3
9	6	5	1	3
10	7	5	2	14

The next step in this problem is clearly that of experiment on the optimum number of tank washings during fermentation, and the Agricultural Officer has agreed to undertake this at the new station factory.

Higher Levels of Nitrogen Application.—Since the 1947 results had shown more response to nitrogen than to other fertilizers, a subsidiary trial was begun on part of the block of coffee containing the manurial experiment. Six replications of a randomized block layout contained the following treatments:—

1. Sulphate of Ammonia at 4 cwt. per acre (94 lb. N per acre).
2. Ammonium nitrate at 2.4 cwt. per acre to give the same 94 lb. N per acre.
3. Sulphate of ammonia at 2 cwt. per acre sprayed on to foliage (47 lb. N per acre).
4. Ammonium nitrate at 1.2 cwt. per acre sprayed on to foliage (47 lb. N per acre).
5. Control.

All applications and sprays were given near the end of the long rains, at the time of the nitrogen applications on the main fertilizer trial.

Results.—Yield expressed as percentage of control:—

1. 90.9 per cent.
2. 85.5 per cent.
3. 82.8 per cent.
4. 102.7 per cent.

The extra nitrogen had depressed the crop, except where immediately available nitrate nitrogen was applied to the foliage while there was enough water available for its use. The depression of crop by heavy nitrogen dressings would be expected in wetter areas, but to find an apparently parallel effect in dry conditions is unexpected and will be further studied.

Yellowing Symptoms.—Halfway through the picking season widespread yellowing occurred, with symptoms typical of nitrogen deficiency. A thorough survey of all yellow leaves on this experiment showed no reduction of yellowing by the heavy nitrogenous dressings. The explanation was sought in soil moisture measurements, and deep sampling showed that all available water had gone from the first 8 feet of soil. Young coffee a few feet away was not yellow, and it was clear that the symptoms which were widespread throughout the drier districts at that time, were due to the attempt to mature a crop under conditions of acute water shortage.

Foliage Tests for Uptake of Phosphates.—All treatment combinations were examined by "tissue testing". The Morgan's extract showed no response to phosphatic fertilizers, but dry ashing of the petioles showed an increase in the total phosphate content of the tissues where both sodaphosphate and nitrogen were given together.

Copper Nutrition of Coffee.—For a second year all fallen leaves were counted on the trees injected with different copper compounds at the Scott Agricultural Laboratories. No signs of effect of copper on leaf-fall were observed. At the end of 1948, the trees were cut down and sectioned. The copper had become widely distributed throughout the trunks and branches, causing damage to tissue in some cases. The failure of such heavy doses of copper to affect leaf-fall indicates that the beneficial effects of copper sprays in this respect are not due to correction of a copper deficiency.

The results of further injection and leaf-fall studies, undertaken in a joint experiment, are given in the report of the Plant Pathologist and Physiologist.

H. C. PEREIRA,
Agricultural Chemist (Coffee Services).

ANNUAL REPORT OF THE SENIOR AGRICULTURAL OFFICER (PASTURE RESEARCH), 1948

Staff

During the year the officer in charge, Mr. D. C. Edwards, conducted the investigation of species for artificially established pastures (temporary leys) at Kabete and also dealt with advisory correspondence and matters relating to the Commonwealth Bureau of Pastures and Field Crops. Mr. A. Bogdan, Pasture Research Officer, was in charge of systematic work at the Scott Agricultural Laboratories, the recording of co-operative experiments in various localities and also carried out other investigations which are indicated in his attached report. Mr. J. A. Allan, Pasture Research Officer, was stationed at Ol Joro Orok, from the beginning of the year until April, when he was transferred to the Coast Province where he was required to assist in the work of the Digo district until August, after which he undertook a vegetation survey of the coastal region. For a portion of the year Mrs. C. L. Cardwell, a temporary assistant, was in charge of work at the Scott Laboratories concerning the quality of locally produced grass seed, depth of sowing and effect of the nurse crop. Mr. H. M. W. Webb, Field Assistant, was employed in connexion with the experimental work at Kabete.

The staff position at the end of the year was as follows:—

Officer in Charge: Mr. D. C. Edwards.

Pasture Research Officers: Messrs. A. Bogdan and J. A. Allan.

Temporary Assistant (Botanist): Mrs. C. L. Cardwell.

Field Assistant: Mr. H. M. W. Webb.

In addition to the above European staff, mention should be made of African Laboratory Assistant John Murage, who rendered valuable service and who was, until 1947, the only member of the technical staff apart from the officer in charge.

Main Lines of Work

Work carried out in the three sections under which the investigations fall is briefly as follows:—

Survey.—This concerns survey of the vegetation designed to provide information upon the ecological regions demarcated by the major plant communities. Attention was devoted to the coastal belt which is a region of relict forest and high bush with open areas of high grass maintained by means of fire. Under rainfall of approximately 45 inches per annum the region is capable of supporting ley farming and it is believed that the natural grassland might react favourably to intensive management. On the basis of the survey information being obtained, it is proposed to establish experiments bearing upon these two lines of development, although practical advance is dependent upon the possibility of controlling tsetse fly infestation throughout the area.

Natural Grassland Types.—As indicated in the 1947 annual report, experiments designed to determine the correct methods of management in the various types of natural grassland demand facilities for work in five main ecological regions of the country. Pending the provision of these facilities, certain urgent problems of management in the areas of European settlement have been attacked on the basis of co-operative experiments on farms and in collaboration with district field staff. Work was continued as under on the three projects already reported:—

(1) Methods of management and the problem of grass burning in the *Acacia-Themeda* grassland of the Highlands. At Ngong where *Themeda triandra* has been suppressed on a part of an experimental area by the exclusion of fire, an attempt is being made to obtain confirmation of the results by inducing the return of this grass under fire treatment. No effect in the desired direction is yet observable.

(2) Near Thomson's Falls an experiment established in 1944 deals with the important problem of a coarse-grass phase dominated by useless *Pennisetum schimperi*, which tends to replace the desirable *Themeda* herbage under present conditions of farming over a wide region situated between the true Kikuyu grass (*Pennisetum clandestinum*) country and the *Acacia-Themeda* vegetation. Various methods of management designed to suppress *P. schimperi* are under investigation and the work continues to indicate that the change to dominant *Themeda* requires the periodical use of fire in herbage accumulated by protection from grazing.

(3) The investigation of deteriorated *Cynodon* (star grass) pastures was continued in the Rift Valley. On the old lake-bed areas concerned, the pastures have in recent years been extensively invaded by *Aristida adscensionis*, an annual grass of low grazing value and of which the fruits penetrate the wool and hides of sheep. The work set up in the area aims at discovering methods of management which will induce the suppression of *Aristida* and the return of the Cynodon herbage. The experiment is only in its second year and definite conclusions cannot yet be drawn, although a year of favourable rainfall appears to have had some effect in the desired direction, and there are indications that marked suppression of *Aristida* is taking place under controlled rotational grazing. In fact, the preliminary results support the original and obvious conclusion that the present condition of the pastures is due to mismanagement over many years, as observed in last year's report.

(4) In addition to the foregoing investigations, assistance was given in connexion with a bush-clearing scheme in the Esageri area, where a trial was established with a view to discovering methods of preventing the return of woody species when clearance had been accomplished. This work has now been extended to include experiments in the use of paraffin in the destruction of *Acacia* and other bush constituents.

Temporary Leys.—The use of pasture leys is gradually advancing in the areas of European settlement, and the imperative necessity under local conditions of maintaing the soil in good physical state by the use of temporary grass in the arable rotation is more widely accepted. In the African areas the need for this development is urgent, and it certainly cannot await the present slow rate of progress if the downward trend in the soil of extensive regions under dense agricultural occupation is to be checked.

Suitable grasses are already available which cover the essential requirements of the main agricultural regions, and further species are nearing the stage of practical application in the work. The position in regard to seed production remains much the same as that reported last year. The Nzoia strain of Rhodes grass (*Chloris gayana*), which is capable of serving the most extensive agricultural region (4,000–6,500 ft. altitude with minimum rainfall of 30 in. per annum), is still in short supply, molasses grass (*Melinis minutiflora*), suited to somewhat higher temperature and moisture conditions within and below the Rhodes grass range, was apparently in just sufficient supply to meet the demand, while a surplus of seed remained on the market in the case of *Bromus marginatus*, which is used in the relatively restricted region at higher elevations.

The main direction of the work intended to provide material for the development of ley farming is towards the isolation of indigenous pasture species suited to the purpose. The basis of the limited advance already made is chiefly the Nzoia strain of Rhodes grass (mentioned above), which is a local ecotype of proved persistence and good seed-producing qualities. No additions have been made to the four new grasses which reached the one-tenth acre seed production stage in the work last year. These are *Pennisetum stramineum, Cenchrus ciliaris* (erect form), *Setaria* (?) *sphacelata* ex Nandi and the Chania River ecotype of *Melinis minutiflora*. Mention should, however, be made of a very promising

variety of *Chloris gayana* which has been called the Alego strain of Rhodes grass. This grass, which has been under trial for some years, was obtained from the Lake Victoria region, and it might well prove to be of value in African agriculture at the lower elevations, when progress is made in the use of the pasture ley in native areas.

In regard to the search for pasture legumes suitable for use in mixture with the ley grasses, a further experiment involving six species with Nzoia Rhodes grass was established at Kabete. So far no legume has been found which is really successful in mixture with this vigorous grass, although lucerne, *Crotalaria intermedia* and *Indigofera tettensis* have all been found capable of surviving in the early stages of the ley. An intensive study of indigenous legumes of possible pasture value was undertaken during the year by the Pasture Research Officer stationed at the Scott Laboratories and this is referred to in his report.

As already mentioned, *Bromus marginatus* has so far served the purpose of early ley development in the European areas at the highest elevations, but it is confidently expected that further grasses will be provided in due course for the climatic region concerned. In this connexion preliminary experiments were set up at the agricultural station at Ol Joro Orok (7,800 ft.) primarily with a view to obtaining clear records of the performance of species of temperate origin. A series of British grasses is being compared with *B. marginatus* and other species which have shown some promise, while clovers are under trial in a separate experiment. The indications to date are that no temperate grasses show even a small degree of promise, but Nzoia Rhodes grass has given very encouraging preliminary results and it appears that it might supersede *Bromus* in this region. Although the natural distribution of the species in East Africa and the source of this particular ecotype under relatively high-temperature conditions provide no guide to these preliminary results, reports of material sent to North America suggest that Nzoia Rhodes grass is in fact capable of withstanding a considerable degree of cold.

The station at Ol Joro Orok is representative of a transitional belt of vegetation where the rainfall is somewhat lower than in the main region of highland grassland or the true Kikuyu grass vegetation at similar elevations, and it has therefore been necessary to extend the above trials to the typical region by means of co-operative experiments on selected farms.

Under the section dealing with ley farming may be included the investigation of weed flora on cereal plots undertaken by Mr. Bogdan, Pasture Research Officer, by arrangement with the Highland fertilizer team of Imperial Chemical Industries. In his report Mr. Bogdan observes that the Kitale area is characterized by a general prevalence of tropical weeds, that in the Ol Kalou area the most important weeds are of European origin and that the Eldoret–Njoro–Nakuru areas have an intermediate weed flora. It is interesting to note that these findings show a relationship to the ecological regions concerned as defined by the major plant communities, Kitale being representative of the scattered tree grassland (low tree–high grass), Ol Kalou within the highland grassland and highland forest region and the other three centres in the transitional vegetation fringing this latter community.

Crops for Fodder Storage

Yield trials of a range of crops intended as reserve fodder were continued. Progress was also made in connexion with the development of a local *sorghum* for use in the drier areas of mixed farming and mentioned in previous reports. A small demand for the improved Kavirondo sorghum, which has resulted from this work, arose amongst European farmers during the year and a grower was appointed with a view to the provision of a commercial seed supply through an agent.

Identification of Pasture Plants

Work in this section increased and approximately 300 specimens were identified. Apart from the requirements of the Agricultural Department and the material received from farmers, there was a marked increase in the number of specimens submitted under suspicion of toxic properties by the Veterinary Department. In the course of the year 650 herbarium specimens were forwarded to the Royal Botanic Gardens, Kew.

Exchange of Plant Material with Countries Abroad

Planting material was supplied to the following countries in response to requests: —

England, Zanzibar, Uganda, Swaziland, Belgian Congo, United States of America, Nigeria, China, Nyasaland, Ceylon, Tanganyika, Gold Coast, Yugoslavia and Madagascar. Material was received from England, Tanganyika, United States of America and South Africa.

Publications, 1948

"Kavirondo Perennial Sorghum: An Improved Type, R2S42." *East African Agricultural Journal,* Vol. XIII, No. 4, p. 202, April, 1948.

Contribution to "The Use and Misuse of Shrubs and Trees as Fodder". Joint Publication No. 10, June, 1947, Commonwealth Bureaux of Pastures and Field Crops, Forestry and Animal Nutrition.

D. C. EDWARDS,
Senior Agricultural Officer (*Pasture Research*).

ANNUAL REPORT OF THE PASTURE RESEARCH OFFICER, SCOTT AGRICULTURAL LABORATORIES, 1948

Work was carried out on the following main lines:—

(1) Study of the grass flora of Kenya.

(2) Experiments on the palatability of indigenous legumes.

(3) Transect readings in co-operative experiments.

(4) Identification of pasture plants.

(5) Study of weed flora.

Grass Flora of Kenya

The primary aim of this work, which was started in 1947, is the compilation of a list and keys to Kenya grasses. Six hundred and fifty specimens, mostly grasses, were added to the collections of 1947. Work in the herbarium of the East African Agricultural Research Institute at Amani (in February) increased the number of grasses on the list to more than 400 species and allowed enlargement and improvement of the keys to Kenya grasses made in the previous year. To make the study of Kenya grasses more detailed and complete, a living collection of grasses (grass nursery) was started at the Scott Agricultural Laboratories and more than 100 species of perennial pasture grasses were planted. This collection proved to be very helpful in studying biological features of practical importance and also in describing some morphological characters which cannot be observed in dried specimens. In order to verify and confirm the names of the grasses 400 specimens (and also 250 specimens of legumes and sedges) were sent to the Royal Botanic Gardens, Kew.

Palatability of Legumes

Observations on the palatability of some indigenous legumes of Kenya were carried out at the Veterinary Research Laboratories, Kabete, in May and June. Thirteen species collected near Nairobi were tested by feeding them to cattle and sheep. Seven species, namely *Alysicarpus glumacues, Glycine javanica, Indigofera endecaphylla, Indigofera retroflexa, Indigofera tettensis, Rhynchosia elegans* and *Vigna fragrans* were found to be palatable both to cattle and sheep. Of these species *Indigofera retroflexa* is considered to be the most promising for introduction into cultivation. It has good seeding qualities, germination is satisfactory and the seedlings proved to be drought resistant. Though this legume has a semi-spreading habit it produces a fairly large bulk of herbage. *Alysicarpus glumaceus* is another promising species. The results of this work have been prepared for publication.

Transect Readings

Soysambu Grazing Experiments.—The second transect readings were carried out in July and October in these experiments, which were started in 1947, and which were designed to discover the best treatment for the suppression of *Aristida adscensionis* in favour of the original star grass (*Cynodon* sp.) herbage in deteriorated pastures of the Rift Valley. The first year's readings showed a general decrease of *Aristida* in nearly all plots of the experiment, probably due to the exceptionally wet year, since a general decrease of *Aristida* was also observed in all pastures of the estate. Plots under light rotational grazing treatment showed a much more marked decrease of *Aristida* together with some variants of heavy rotational grazing, while permanent grazing resulted in a very slight (if any) decrease of this pasture weed.

Esageri Bush-clearing Scheme.—In connexion with the Esageri bush-clearing scheme (20 miles from Nakuru), 40 belt transects were laid down on experimental plots and the initial readings were made in September. These experiments, under

the supervision of the Senior Agricultural Officer, Rift Valley Province, are designed to ascertain the best treatment of cleared land for pastoral purposes, and the records were undertaken in order to trace the change of vegetation under different treatments. Uncleared woodland of the experimental area consists of *Acacia senegal, Acacia hebecladoides, Acacia subalata, Acacia seyal, Acacia pennata, Tarchonanthus camphoratus, Albizzia amara* and *Dichrostachys glomerata* with a rather scant grass cover in less shady places and forest herbs in shade. Though the first results of the experiment cannot be expected until after two to three years, some preliminary conclusions on the general trend in the plant succession connected with the clearing can be drawn from observations on the vegetation of the areas cleared at different times. The cleared area is covering rapidly with star grass (*Cynodon dactylon* and to a lesser extent *Cynodon plectostachyum*) which suppresses the herbs growing under trees. At a later stage of the succession come tufted perennial grasses with the dominance of *Cymbopogon plurinodis* (?) and with a conspicuous admixture of *Themeda triandra* and *Eragrostis superba.*

Identification of Pasture Plants

Two hundred and fifty specimens, mostly grasses and legumes, received through the Senior Agricultural Officer (Pasture Research), were named. The specimens were sent for identification partly by farmers and the agricultural and veterinary officers (137 specimens) and partly by the Pasture Research Officer surveying the coastal vegetation (113 specimens). In addition, some 50 specimens of grasses were identified for the Game Department.

A collection of 60 species representing the dominant grasses of different types of Kenya grassland was supplied at the request of the Ministry of Agriculture Grassland Research Station, Stratford on Avon, England.

Weeds

An investigation of weed flora in connexion with the Highland Fertilizer Experiment Scheme was undertaken as agreed between the East African Agriculture and Forestry Research Organization and this Department. The main aim of the investigation was to discover weeds which could serve as indicators of the soil requirement to certain minerals. Forty-three experiments in Kitale, Eldoret, Ol Kalou and Nakuru–Njoro areas were visited and a detailed survey of weeds was carried out in July and September. The results of this work were handed over to the officers concerned for statistical analysis. In the course of the work, general information was also obtained concerning the distribution of weeds in the above areas. About 100 species of weeds (of which number only about 30 species are, however, of considerable practical importance) were recorded and their distribution in the above areas was traced. It can be stated that the weeds of European origin are all annuals and that all perennial weeds in the surveyed area belong to local African species and, to a lesser extent, to the general tropical weeds. Some of the local perennial weeds with deep, spreading rootstocks, e.g. *Senecio ruwenzoriensis* and *Wahlenbergia virgata,* are potentially noxious, though for the time being they are not widely distributed in the arable land. The presence of some noxious European weeds, such as wild oats (*Avena fatua* s.l.) and wild radish (*Raphanus raphanistrum* and *R. sativus*), which probably have only recently arrived in this country, has also been noted. These weeds were only met with in some localized areas, but in these areas they appear in masses, menacing spread into adjacent land. The areas examined show distinct differences as to their weed flora. While Kitale area is characterized by the strong prevalence of general tropical weeds, in the Ol Kalou area the most important weeds are those of European origin. Eldoret and Njoro–Nakuru areas have a weed flora of intermediate type.

A. BOGDAN,
Pasture Research Officer.

ANNUAL REPORT OF THE AGRICULTURAL OFFICER (HORTICULTURE), 1948

Staff

European.—Mr. T. H. Jackson, Agricultural Officer (Horticulture) was in charge of all horticultural investigational and extension work during the year.

Mr. A. C. Howden, Assistant Agricultural Officer (Hort.), arrived from South Africa on first appointment on 17th November, and was posted to Matuga.

Mr. C. Maas, Assistant Agricultural Officer (Seeds), joined the Department in April and was in charge of the Seed Cleaning Plant at Nakuru; he also carried out extension work on seed crops.

African.—

Clerk, 1.

Field Assistants, 4.

One Field Assistant was transferred to field services during the year.

Travelling

Total mileage travelled: Mr. Jackson, 8,030 miles.

Total mileage travelled: Mr. Maas, 6,112 miles.

Horticultural Training

Two African Agricultural Instructors from Central Province and two from Nyanza Province were seconded to Molo during the year for a three months' horticultural course.

The Horticultural Industry

Increase in Acreage.—The figures for importation of fruit trees into Kenya from South Africa give a reliable picture of the expansion of fruit tree planting; it should be remembered however that the demand for fruit trees considerably exceeds the supply. In many cases growers who ordered trees this year have been offered delivery in 1950.

The figures for importation of trees for the last three years are as follows:—

1946—301 packages valued at Sh. 43,380.

1947—344 packages valued at Sh. 58,451.

1948—426 packages valued at Sh. 71,640.

The figure for 1948 represents about 240 acres of fruit trees.

The acreage of pine-apples is increasing and is estimated to be at present about 260 acres grown by Europeans, whilst a recent survey carried out in the Kiambu native reserve revealed that 410 Africans had planted a total of 387 acres during the last three years. The passion fruit acreage has also increased; the present acreage in Sotik district is about 600.

Vegetable production has also increased; this is partly due to the large quantities absorbed by the East African War Supplies Board. A new departure is the production of some particularly fine onion crops by several farmers in Upper Molo district.

Fruit and Vegetable Processing.—Probably the best chance of finding an outlet for our fruits and vegetables outside East Africa is through processed products. By this is meant the preservation of fresh produce by canning and drying, and the manufacture of cordials, jams, chutneys and pickles. At present there are eight factories in Kenya turning out these products, chiefly for the local market. Five more factories are proposed, and at least two of these are in course of erection.

The best prospect at present is for canned pine-apple. Three of the proposed canneries intend to make this their principal product; the promoters feel that they can produce canned pine-apple cheaply enough to compete favourably on the English market. Another fruit which made its debut as a canned product this year is the Cape gooseberry. This humble but delicious fruit, which can be grown successfully from the coast up to 9,000 feet in the highlands, offers tremendous possibilities provided that it proves popular on the English market. It would also be worth while to investigate the possibility of exporting this fruit, preserved in sulphur dioxide in barrels, to South African jam manufacturers.

Fruit drying is a method of preservation which can be carried out with a minimum of inexpensive equipment by growers themselves. Fruit can be dried in the sun or in pyrethrum driers. I know of two growers who are sun drying fruit on a small scale, and both are producing an excellent product which finds a ready sale. One of these growers told me that it paid him better to dry his peaches than to sell them fresh. Fruit drying is a process which might well be taken up by other growers, particularly in the districts around Plateau where many peaches are grown and go to waste each year, because of difficulties in marketing them fresh.

It is felt that some of the local processing plants are not being operated quite so efficiently as they might be, due to failure of the management to make contracts with growers in advance for the supply of their raw material. Such hand-to-mouth methods often result in plants running considerably under capacity, and therefore uneconomically, during the season.

Seed Crops.—No figures are available this year for the total acreage of seed crops. This is partly due to the unwillingness of certain seed production agents to reveal details of their contracts. It is hoped to overcome this difficulty next year by issuing a questionnaire to all known seed growers. During the year the Seed Inspector inspected 971 acres of vegetable and flower seeds. In the Kitale and Eldoret districts, 3,406 acres of cereals seeds were inspected. The bulk of the vegetable seed crops was garden peas. Owing to the late rains it was not a good season for pea seed crops. Many growers had great difficulty in drying off their crops for harvest, and some crops were completely lost through heating of the seed as a result of bagging it wet.

Fruit Crops.—Varied reports have been received on the 1948–49 fruit crop. The mango and cashew nut crop at the coast is poor to fair, probably due to rain at flowering time. A good crop of mangoes was seen at Thika. From Limuru it it reported that deciduous fruit crops are poor. Kinangop reports a poor set of apples. The Molo apple and pear crop is reported to be good. Plateau district peach crop is good.

Extension Work

An increasing amount of time is spent on advisory correspondence. Owing to the wide variety of crops and climates dealt with, it is not possible in many cases to make use of stereotyped replies. During the year most districts were visited for the purpose of advising growers personally. Visits were also paid to several native areas. Horticultural development reports were produced for Nyanza Province, and South Nyeri district.

Agricultural Shows.—Horticultural exhibits were staged at "The Country Comes to Town" exhibition at Nairobi, at the Royal Agricultural Society's Show in Nakuru, and at the Nyanza Provincial Show held in Kericho district.

Field Days and Demonstrations.—A Farmers' Day was held at the Molo Station on 16th October for both pyrethrum and fruit. Visitors were conducted

round the orchard, and the pruning of fruit trees was discussed. The effect of oil sprays on the dormancy of fruit trees was demonstrated, and aroused great interest. A demonstration of apple budding was given in the nurseries.

The Farmers' Day at Ol Joro Orok was held on 2nd October. Visitors were shown the newly planted orchard, and the irrigation layout was explained. A demonstration of apple pruning was given at the Field Day held on Mr. J. Etherington's farm, South Kinangop, on 10th July.

In August two pruning demonstrations were held at Molo for the students of the Egerton School of Agriculture. The demonstrations were held at the Molo experiment orchard and at Capt. Grey's orchard. A lecture on "Fruit Growing in Kenya" was given at the Egerton School to the students.

Broadcast.—In October a broadcast entitled, "Some Sub-tropical Fruits". was given in the series organized by the Kenya Horticultural Society.

Investigational Work

Owing to shortage of staff it has been possible to spend only a small amount of time on investigational work during the year.

Prolonged Dormancy.—Prolonged dormancy of deciduous fruits is probably the chief limiting factor in their successful cultivation in the Kenya Highlands. It it therefore particularly pleasing to be able to report good progress in the control of this trouble by means of oil sprays. Trials with oil spraying were started, on a small scale, in 1946, using a five per cent emulsion of raw linseed oil. Results were encouraging, but the spray was expensive and the emulsion somewhat difficult to make successfully. No trials were made during 1947 owing to my absence on leave.

This year trials were made with four proprietary oil sprays at the Molo experiment orchard, and at three private orchards. The sprays used were as follows:—

1. Shell Universal Winter Wash.
2. Capsine
3. Ovicide
4. Spraymac

} material kindly donated by Plant Protection, Ltd.

Numbers 1 and 2 are D.N.O.C. oil emulsions, designed for winter use as insecticides. Numbers 3 and 4 are tar oil sprays designed for the same purpose. All four sprays will kill moss and lichen on fruit trees, and have a strong burning action on vegetation. The trials were carried out with all sprays at a dilution of five per cent with water. Peach, plum, apple, pear and apricot trees were sprayed at Molo at weekly intervals for a period of seven weeks during the dormant season, starting on 27th July and continuing to 13th September.

From the results obtained it is evident that the time of application is critical. At Molo the trees which reacted best were those sprayed during the second half of August. Trees sprayed during the first half of August or in late July showed little or no reaction. If spraying is delayed until September there is a danger of burning the buds, which with most kinds of fruit have started to open by this time. Trees which reacted well to the spray opened their blossom and leaf buds more regularly, in larger numbers, and earlier than unsprayed trees. Thus an October Purple plum tree, No. 73, sprayed with Capsine on 21st August, had nearly all its buds breaking by 6th September, whilst the control tree showed no sign of breaking. On 23rd September, No. 73 was in almost full flower, but only odd buds were starting to open on the control tree. The crop from No. 73 was harvested between 15th and 21st February, 1949, and at this time the control tree was bearing mature fruit, half-grown fruit and flowers all at the same time. A number of flower and leaf buds on this tree were still dormant.

It was found possible to change slightly the time of flowering and of harvest with plums, by varying the date of spraying. Thus a Tazagine plum tree, No. 63, sprayed on 21st August was in full flower exactly one week before another tree of the same variety, No. 57, which was sprayed on 28th August. The harvest from No. 63 was slightly earlier than from No. 57. The first picking from both trees was made on 28th December, but the weight of fruit picked from No. 63 was three times greater than from No. 57. A control tree of this variety, No. 58, ripened its crop considerably later, the first picking being made on 15th January, 1949. Spreading the crop is of importance with plums in order to extend the season which is normally very short, often causing a glut of fruit on the market.

Two Blenheim Orange apple trees planted at Molo in August, 1947, were sprayed in early September. These trees set a very large crop of fruit, most of which had to be picked off owing to the age of the trees.

Of the four sprays tried, all produced good results, and there was no observable difference between them. The trials described above were on a comparatively small scale, and mostly conducted with young trees; they cannot be regarded as in any way final. The results however are so encouraging that no hesitation is felt in recommending growers to spray their trees with an oil spray at the optimum time during the dormant season. Spraying is recommended for apples, pears, plums and apricots. In many cases peaches will also benefit from spraying. It has been reported from other countries that burning of the bark or buds has resulted from the oil spraying of peaches. No burning has been observed on peach trees sprayed at Molo, but it is recommended that peaches should be sprayed with caution. Trials will be continued on a larger scale in 1949.

Apple Rootstocks.—A statistical rootstock experiment is to be laid down at Molo. The necessary trees for this experiment will have to be propagated in the Molo nurseries. Rootstocks for this experiment have been collected and planted in the nurseries, and it is expected that the stocks will be budded in 1949. The experiment will not be planted out before 1951.

There is little to report, as yet, on the trees on experimental rootstocks imported from Stellenbosch Research Station and planted at Molo in 1947, except the following: Ohinemuri on rootstock A13, all trees have died back to the bud union; this result would seem to indicate some degree of incompatability between this combination of stock and scion: Granny Smith on rootstock A30, all trees show a large swelling at the union, which is an indication of a certain degree of incompatability.

In January, a further consignment of apple rootstocks was received from East Malling Research Station; these stocks were planted out to form layer beds at the Molo nurseries. This consignment included a number of Crab "C" stocks, which at East Malling are extremely vigorous. Crab "C" at Molo is exceeded in vigour by No. 12 and 10 of the Malling new immune series, at least in the first season of growth.

The multiplication of Malling stocks from the layer beds at the Turi nursery continued during the year. A few Malling rootstocks were issued to growers for experimental purposes. Young trees on Malling stocks of the immune series, Nos. 10, 12, and 411, continue to make good growth.

A trial was started in August on the effect of inarching some of the more vigorous Malling rootstocks on to mature apple trees which are at present on Northern Spy stock, and which are normally weak growers. The object of this experiment is to infuse more vigour into trees on Northern Spy, and also provides another method of testing these new rootstocks. The experiment is being carried out in four private orchards. Two methods are being adopted as follows:—

1. Two rootstocks are planted in August about 9 in. on either side of the tree which is to be treated. The tops of the stocks are cut off and grafted into

the trunk of the established tree by the method known as rind inarching. The grafting is done immediately after planting the stocks.

2. As for 1, but the stocks are left to become established thirteen months before grafting.

Results to date are highly successful, so far as establishing the stocks is concerned. It is too early yet to be sure of the success of the graft unions made by the first method.

Nutrition.—Leaf symptoms, particularly on apples, of what appears to be potash or magnesium deficiency have been noticed at Molo and in many private orchards. A small trial with sulphate of potash is being carried out at Molo. Sulphate of potash was applied as a soil dressing in May to a number of trees in the Molo orchard, at the rate of 200 lb. per acre. As yet the treated trees show no reduction in deficiency symptoms as compared to the controls. A further trial will be made using a heavier dressing of potash.

Seeds.—A trial was carried out in co-operation with Messrs. Sutton and Sons, Ltd., of Reading, England, to determine to what extent the viability of vegetable and flower seeds is reduced on the journey by surface mail from England to Kenya. The result of this trial indicated that reduction of viability is negligible.

Seed production trials of a large number of kinds and varieties of flowers from Messrs. Suttons were carried out at Molo to determine which kinds can be produced successfully in Kenya. It is interesting to note that certain kinds, which normally flower well from local seed, flower with great reluctance or not at all when grown from imported seed. A good example of this is *Cynoglossum* (Hounds-tongue) which grows wild in Kenya and flowers profusely. Seed of *Cynoglossum*, Blue Gem, received from Messrs. Suttons, was sown at Molo and some 200 seedlings planted out; not a single flower was produced.

The lists which follow give (1), the kinds recommended for commercial seed production in Kenya in Molo or similar climate, and (2), the kinds not recommended, based on the result of the trials.

1. *Kinds recommended for commercial production*:—

   Petunia, Phlox Drummondii, Verbena, Pansy, Portulaca, Calendula, Dianthus, Antirrhinum, Gaillardia, Stock, Dahlia, Coltness hybrids, Aster, Dimorphotheca, Hollyhock, Salvia, Schizanthus, Freesia, Nasturtium, Statice sinuata, Convolvulus Major, African Marigold, Sweet William, Ageratum, Alyssum minimum, Candytuft, Zinnia, Larkspur, Mignonette, Rudbeckia, Sweet Pea, Gypsophila elegans, Hibiscus trionum, Clarkia elegans.

2. Kinds not recommended for commercial production:—

   Wallflower, Pyrethrum, Myosotis, Celosia, Cynoglossum, Cheiranthus allionii, Golden feather, Aquilegia.

Pruning and Thinning.—A pruning and training experiment with own rooted Keiffer pears is in progress. The object of this experiment is to reduce the rather long period which generally elapses before trees on their own roots come into bearing. The method adopted is to bend over and peg down the main branches in a horizontal position, thus reducing the flow of sap. Strong growths which arise from the centre of the tree after the main branches have been bent over are suppressed by summer pruning. Control trees are pruned in the normal way. The experiment was started in 1946, soon after the trees were planted. This year the treated trees produced flowers in considerable numbers. Very few flowers were produced by the control trees. No fruit was set owing to there being no flowers on the pollinating variety.

A small trial on the thinning of peaches is in progress, the result of which will be reported next year.

Grading and Packing.—The experimental fruit grader, which was constructed in my private workshop, has been completed. The machine is entirely successful, and was exhibited working at Nakuru Show, and Nyanza Provincial Show. The machine is being made and sold by a local firm. A number of units have been ordered by growers and government departments.

A simple jig for making fruit boxes has been constructed at Molo.

New Introductions and Reports on Individual Crops

Melon Berry, Solanum sp.—Some small plants were received from the Senior Entomologist in 1946. These plants came originally from Abyssinia, where the melon berry is indigenous, in the region of Addis Ababa. Planted at the Turi nursery the plants grew rapidly, and have fruited heavily. The plants grow about 18 in. high, have blue flowers and small glossy leaves. The fruits average 2½ in. long by 1¼–1½ in. diameter and are pale yellow when ripe; at Turi they are seedless. The fruit has the flavour of a Canteloupe melon. The plants are easily propagated by splitting. Dr. Le Pelley reports that the melon berry refused to grow in Nairobi. This fruit is recommended for planting in the Highlands.

Boysenberry.—Boysenberry plants were planted at Molo in 1947, where they are now growing well and fruiting. It has also been seen growing successfully in Turbo and Naro Moru, and would appear to be suited to quite a wide range of climates. Of similar habit to the loganberry, the boysen should be grown on a wire trellis. The old canes should be cut off after they have fruited. The fruit is large, dark red and of good flavour. Not much fruit can be expected until two years after planting.

The boysenberry is recommended for planting at medium to high altitudes.

Rubus spp.—A collection of indigenous *Rubus* spp. has been started at Molo for observation of their reaction to cultivation, and as a source of material for future breeding work.

Seedling Raspberries.—Seed of the following raspberries was obtained from the John Innes Horticultural Institute:—

1. Lloyd George.

2. Norfolk Giant.

3. Lloyd George X Norfolk Giant.

The seed was sown at Molo in April, after being stored in moist sand in a refrigerator at the Scott Agricultural Laboratories for two months. Several seedlings of No. 1 have been raised; No. 2 failed to germinate and only one seedling of No. 3 has been raised. Some of the seedlings have made good growth but have not fruited yet. The suckers from each seedling are being planted separately.

Syrian Apricot.—Seed of the Syrian apricot was imported from Syria by Mr. C. Morris of Koru, and was sown at Molo in March. A few of the seeds germinated but the subsequent growth of the seedlings is very disappointing.

Cider Apples.—Trees of a number of cider apple varieties arrived from England in January, and were planted temporarily in the nursery. Some varieties made promising growth during the first season.

Gargir.—Seed of Gargir which is a cruciferous spinach, much grown in Egypt, was imported by Mr. C. Morris of Koru and planted at Molo in December. The plants quickly ran to seed, possibly due to hot dry weather. Seed is being collected and will be distributed for trial in due course.

Cola Nut.—Seed of cola nut, *Cola acuminata,* was imported from Nigeria in September. The seed arrived in poor condition. It was distributed to several departmental stations and private growers. Reports received so far indicate that germination has been poor but it is hoped to raise a few plants for trial.

Macadamia Nut.—A few seeds of macadamia nut, *Macadamia ternifolia,* were received from head office in December and distributed to Kakamega and to a private grower at Thika; no reports yet received. A few macadamia trees planted at Kibarani, Kilifi, in 1941, are now about ten feet high but have not fruited yet.

Pests and Diseases

Insect Pests.—Little trouble was experienced with insect pests during the year. An infestation of red spider appeared on the Cape gooseberries; at Molo spraying with lime sulphur at a strength of 1 : 60 appeared to have little effect. Fruit sucking moth is causing damage to mangoes in Nyanza, to citrus at Mwatati, and to pears at Limuru.

Diseases.—Peaches at Molo were fairly badly infected with peach leaf curl. Spraying was not carried out owing to the very irregular opening of the flower buds this season. One tree which was sprayed with Capsine against delayed foliation showed a greatly reduced infection. Diseased shoots were removed and burnt.

Several almond trees died during the year; it is not quite clear whether death was due to *Rosellinia* root rot or to gummosis.

Rosellinia root rot caused the death of several apple trees. The fungus appears to make contact with the tree roots from the stumps of old forest trees, which are often a considerable distance below the surface. When a tree dies the area surrounding it is isolated by means of a trench dug to a depth of two and a half feet. Several orchards at Limuru are seriously infected with *Rossellinia* or *Armillaria* root rot.

Apple mildew was reported to be serious in an orchard at Limuru, possibly due to the late rains.

A disease of cultivated varieties and wild species of *Rubus* is becoming serious. The chief symptom of the disease is that the young fruit, instead of developing turns brown and dries up. Sometimes the flowers are affected. In many cases every fruit on a fruit spur is attacked, and the spur itself dies back to its junction with the cane. Almost invariably a new bud starts to grow at this point shortly afterwards. The tips of the canes are sometimes attacked, die back for a few inches, and are are replaced by a new shoot starting near the end of the dead tissue. Brownish lesions are also to be seen on the canes. In cultivated berries the disease may not appear for several seasons, but when it does it is usual for all fruit to be attacked season after season, no fruit at all reaching maturity.

The Senior Plant Pathologist has isolated the fungus *Glœosporium* from samples of infected material, but it is not known yet whether this fungus is the cause of the disease.

Development of Stations

Molo.—The three-roomed office building has been completed and occupied. The combined stores and workshop has been built and is in use. Sites for the Agricultural Officer's house, and the underground fruit store have been prepared. Construction of the dam has proceeded slowly throughout the year and is now almost complete except for the spillways. It was rather disturbing that water accumulated in the dam appeared to be leaking out through some weak place in the floor. A 5,000 gallon stone tank has been built in the top corner of the nursery. This tank is part of the irrigation works, but it will also supply water to the officers' houses and labour camp. The tank is supplied by the ram, and water for irrigation will be pumped into it from the large dam, when this is completed.

A nursery for propagation of fruit trees, vegetables and seed trials has been made. The nursery is about two acres in area; it is bench terraced, and laid out

for irrigation. A buck-proof fence has been constructed round it. It is unfortunate that the soil in the nursery is poor; heavy manuring will be necessary to bring it into good heart. Flower seed trials were planted in beds round the office building and in the station approach.

Bench terraces have been made and holes dug for a small extension to the orchard. A start has been made with the breaking of the fourteen acre Kikuyu grass paddock which is to become a new orchard. As only one ox plough is available, breaking this land is extremely slow work. It is hoped to have part of the land ready for planting in 1949. A hedge of *Lycium horridum* has been planted along one end of the orchard. In the orchard some of the peach, plum and almond varieties and one apple variety carried their first crop.

Ol Joro Orok.—The experimental orchard was planted out in August. The subsequent growth of the trees has been most disappointing; this is probably due to a combination of poor rainfall, competing weed growth and high winds. It is unfortunate that the bench terracing of the orchard site was carried out before all the Kikuyu grass roots had been removed. The necessary four-inch piping for the irrigation pipeline has been purchased. Owing to shortage of pipe fittings it has not yet been possible to lay the pipeline. A disc harrow for the Trusty tractor was purchased for orchard cultivation.

Kitale.—The proposal to have a fruit sub-station at Soy or Hoey's Bridge has been abandoned in favour of a site at the Prison Farm, Kitale. Soil tests have been carried out on the site, and the soil is considered suitable. The proposed area is five acres. The site is near one of the prison dams from which it is proposed to pump water for irrigation. It is hoped to start development of this station in 1949 if funds are available.

Mariashoni (*high altitude*).—A suitable site for this sub-station, area five acres, has been chosen adjoining the Forest Department nursery at Mariashoni, altitude 8,800 feet. Water is pumped from a river nearby the Forest Department nursery. Part of this water could be used for irrigating fruit trees if a storage tank and delivery pipeline are provided. Development of this site could be started in 1949 if funds are available.

Seed Cleaning Plant

The seed cleaning plant from Turi is now erected in the Pyrethrum Board building at Nakuru. The plant was operated by Mr. C. Maas, Seed Inspector. The expenses of operating the plant during the year, exclusive of European supervision and depreciation, were as follows:—

	Sh.
Capital Expenditure	943.85
Recurrent Expenditure	605.61
Total	Sh. 1,549.46

The revenue obtained from seed cleaning fees was Sh. 469.72. The total weight of seed cleaned, given here as weight of clean seed, was 94,298 lb., most of which was seed peas.

Cereals Cleaning Plant.—Most of the machinery for the proposed cereals cleaning plants, to be erected at Nakuru and Eldoret, has arrived from England and is at present stored at Nakuru. Suitable building plots have been obtained for the Nakuru plant. No site has yet been obtained at Eldoret owing to the delay in surveying industrial plots there.

Meteorological

Molo Research Station

Monthly Totals of Rainfall for 1948.

	Inches	No. of days
January	0·05	1
February	0·27	3
March	2·41	12
April	7·40	19
May	3·97	23
June	5·14	22
July	9·82	21
August	8·14	20
September	4·68	16
October	3·39	19
November	1·62	13
December	2·25	11
	49·14	180

Monthly Temperatures

	Mean Max. °F.	Mean Min. °F.	Mean Temp. °F.
January	72·2	42·0	57·1
February	74·4	41·9	58·1
March	71·8	44·5	58·1
April	70·2	45·4	57·8
May	69·2	46·0	57·6
June	65·9	44·8	55·3
July	64·2	44·6	54·4
August	65·6	43·3	54·5
September	68·1	42·6	55.3
October	72·3	44·0	58·1
November	66·8	45·8	56·3
December	66·4	46·3	56·4

For rainfall and temperature records at Ol Joro Orok please see report by the Agricultural Officer (Pyrethrum).

Imports of Fruit Through Kilindini

	1946		1947		1948	
	No. of Packages	Value	No. of Packages	Value	No. of Packages	Value
		Sh.		*Sh.*		*Sh.*
E.A. Territories ..	69,954	548,941	14,811	116,015	20,218	139,484
Overseas	20,054	687,974	28,356	670,067	28,913	541,645

It is regretted that no figures are available for fresh fruit imported through Kisumu from E.A. Territories.

T. H. JACKSON,
Agricultural Officer (Hort.

ANNUAL REPORT OF THE AGRICULTURAL OFFICER (PYRETHRUM), 1948

Staff

Mr. E. W. Gaddum, Agricultural Officer (Pyrethrum) was in charge throughout the year. He was stationed at Ol Joro Orok.

Dr. P. W. U. Kroll, Assistant Agricultural Officer (Pyrethrum) was stationed at Molo throughout the year.

Trained African staff consisted of five Field Assistants and one Clerk.

Experimental Stations

Ol Joro Orok (7,800 ft.).—Growing conditions were not very good for pyrethrum. The long rains did not break until 19th April and the picking season was late in starting. There were considerable dry spells in August and September when the main flush occurs.

A nursery was constructed in connexion with the plant breeding work.

In August, a tornado struck the pyrethrum drier. Bits of corrugated iron were blown several hundred yards and the stone wall was destroyed almost to ground level in some places. Repairs were carried out and the drier was in use again before the end of the season.

Molo (8,300 ft.).—A house for the Assistant Agricultural Officer (Pyrethrum) was completed by the end of August.

A three-roomed office for the joint use of the Agricultural Officer (Horticulture) and the Assistant Agricultural Officer (Pyrethrum) was built early in the year.

A stone building consisting of a carpenter's workshop and small stores was built for the joint use of the pyrethrum and horticultural sections.

Work was started on the construction of a dam. This is primarily for the irrigation of the orchard but the dam wall will also serve as a bridge for the road to the pyrethrum plots.

The season at Molo was more favourable for pyrethrum than at Ol Joro Orok and normal yields were obtained.

Kinangop (8,300 ft.).—This station was closed down in April, on the completion of the 1947–48 trials. It was decided that there were insufficient field trials to warrant the continuation of this station and that the plant breeding work could be more satisfactorily concentrated at Ol Joro Orok, Molo and Subukia.

Subukia (7,000 ft.).—Work consisted mainly of a continuation of some of the previous trials and the testing out of various new strains for their suitability to low altitudes.

Some maize planted after pyrethrum gave a yield of 24 bags per acre.

A trial of pyrethrum at close spacings was carried out.

Kitale (6,300 ft.).—This comparatively low altitude station was used mainly as a testing ground for some of the new selections and crosses.

Cultural Experiments

In 1947–48 there were 30 statistical trials devoted to such problems as cutting back, fertilizers, seedlings versus splits, etc. Most of the agronomic studies described in the 1947 Annual Report had been completed by the end of that season and it was decided to extend the plant breeding work rather than to start a further series of agronomic trials. The number of statistical trials were therefore reduced from 30 in 1947/48 to 15 in 1948/49. Details are given below:—

Experiment	Ol Joro Orok	Molo	Subukia	Kitale
Mulching	1	1	—	—
Ox Cultivation	—	—	1	—
Rotations	2	—	—	—
Spacing	1	—	1	—
Variety Trials	2	2	1	1
Vegetative Propagation	1	—	—	—
Weeding	1	—	—	—

Mulching.—Mulching has given some encouraging results in the past. Two trials are in progress, at Molo and Ol Joro Orok.

Ox Cultivation.—This trial has now been running for two seasons. It has shown that the judicious use of a mechanical cultivator combined with hand cultivation need not cause reduced yields.

Rotations.—These two trials at Ol Joro Orok were briefly described in the 1947 Annual Report. Complete results will not be available for several years. It was found, this season, that wheat following pyrethrum yielded much better than wheat following *Bromus*. The wheat was planted in July and both treatments suffered considerably from the dry weather in August and September:—

Wheat following pyrethrum (ten plots), 1,320 lb./ac.

Wheat following *Bromus* (four plots), 612 lb./ac.

The formal rotation trials are supplemented by a smaller trial at Molo to test the effect of green manuring in between successive pyrethrum crops.

Spacing.—In the earlier trials, it was found that yields generally increased up to 14,520 plants per acre, the closest spacing tried. A trial was planted at Ol Joro Orok in 1947 and at Subukia in 1948 to test spacings in the range 14,520 to 38,720 plants per acre.

The results obtained so far suggest that the optimum plant population is in the neighbourhood of 20,000 to 25,000 plants per acre. Spacings of this order produce a good yield in the first year and the plant mortality is not too serious in the second year. Closer spacings may result in overcrowding even in the first year and there is a substantial loss of plants in the second season, due to the severe competition.

Variety Trials.—The six variety trials under observation this year were concerned with the testing out of clones and crosses resulting from the plant breeding work.

The vigorous strain produced by Mr. G. S. Powell at Elburgon has maintained its high yielding qualities and this year seedlings from crosses of Powell's strain with various high toxic clones were planted in yield trials. Results are not complete but it appears that plants from these crosses should be vigorous and large flowered though the pyrethrins content tends to be rather low.

The trial at Subukia is intended to test the more promising strains at a low altitude. It is satisfactory to record that at least two of the new high content strains, 214 and 194, have done well in this trial.

One trial at Molo, planted in 1947 to test seedlings of the (14 by 24) strain, was chiefly remarkable for the extremely high yield of the control—seedlings grown from an ordinary commercial sample of seed. The control plots gave an average yield of 1,971 lb./ac., the largest recorded so far on the experimental stations. The average yield of the trial was 1,046 lb./ac. Selections are being made within the control plots.

Transplanter Trials.—In 1947 the Pyrethrum Board imported two types of mechanical transplanter for trial, the Quickstart and the Multiplanter. It was not possible to test them fully in 1947 but trials were carried out in 1948 on Mr. W. F. B. McLellan's farm at Thomson's Falls. A third type, the Robot, was in use on Mr. H. D. White's farm at Ol Kalou and permission was kindly given for a series of trials of this machine.

The African is comparatively slow and clumsy in feeding transplanters. Consequently, it is sometimes difficult to drive a tractor slow enough for African labour to carry out the work efficiently. This difficulty was experienced with the Quickstart and to an even greater degree, with the Multiplanter, neither of which proved very suitable under our conditions.

The Robot provides accommodation for four operators and plants one row at a time. Under these conditions the African can keep pace with the machine quite easily, even when the spacing of plants in the row is as close as 12 in. Planting speeds averaged about 90 plants per minute. Weather conditions after planting were not particularly favourable but in spite of this a stand of 89 per cent was obtained.

As regards planting efficiency, the Robot can be recommended, but the present high cost of the machine is likely to militate against its general adoption. The speed at which a transplanter works is limited by the skill of the operators. With Africans, the speed was much less than is usual in Europe.

Miscellaneous Trials.—Some small trials were carried out on a variety of subjects:—

The influence of temperature on the germination of pyrethrum seed was investigated by the Senior Plant Pathologist. At 30° C. the germination was nil. Germination was best at 15° C. but the seed took longer to germinate than at 25° C. The practical implication of this work is that seed beds must be kept cool with a grass mulch until germination is complete.

Mixing ashes with seed before sowing, had no effect on germination.

Spraying seedlings in the nursery with a solution equivalent to 50 lb./ac. of sulphate of ammonia had no effect on growth.

There is a negative correlation between the spacing at which pyrethrum is planted and the stand. Wider spacings, mean bigger, more vigorous plants and a high survival rate—but the yield per acre is less.

Burning back was compared with cutting back. It may be possible to do this under favourable circumstances but under the conditions of the experiment burning back caused a reduction in stand and delayed flowering.

Plants of a single clone were established at various stations in order to study the effect of altitude on pyrethrins content.

Plant Breeding

The plant breeding work is carried out in collaboration with the Senior Plant Breeder, Njoro, and is described in his report.

Some correlation studies showed that in selection work "number of flowers" is much more important than "flower size" as an index of yield. "Flower size" is relatively unimportant because there appears to be a tendency for plants with large flowers to bear comparatively few of them and thus the yield is less than might otherwise be expected.

Vegetative Propagation—The final stage in the breeding of a new strain is the vegetative bulking of the parent clones until there are sufficient plants for a seed production field. Vegetative bulking by means of splits is very slow. One plant may give ten splits and it is doubtful whether one would be able to produce more than about 100 splits from a single parent in a season.

Trials were carried out on a system of propagation by means of soft shoot and hard wood cuttings. This method gave good results. It was found that instead of about ten splits from a single plant, it is possible to obtain 120 to 250 cuttings. When planted in boxes, 80–90 per cent of the cuttings survive, under favourable conditions, and produce further cuttings for propagation after a few months.

Several trials were carried out to find the most satisfactory technique. The potting mixture had a decided influence but two types of plant hormone had no effect. A heating frame gave poor results as compared with planting in the open. The use of muslin cloche may be of use in the propagation of hard wood cuttings but had little effect on soft shoot cuttings.

Rooted cuttings were found to grow well if planted out under irrigation. At this stage, it was found that a successful alternative method of propagation was by layering.

There is no doubt that propagation by cutting is very much more rapid than by splits and the experience gained this year will be invaluable when the actual work of propagating new strains for issue commences in 1949.

Pests and Diseases

Bud Disease.—As in 1947, bud disease was present in practically all pyrethrum-growing areas but did not cause much apparent loss except in a few instances.

There was an outbreak on the North Kinangop in September. At the peak of the attack, losses were up to 20 per cent but the attack only lasted a few weeks.

The cold, sunless weather experienced towards the end of the year, was associated with some increase in the disease at very high altitudes in November and December.

Losses on experimental stations averaged about five per cent over the season as a whole.

Studies were continued on the possible relationship between the disease and climate. This work has now been carried out for two seasons and it would appear that in the absence of climatic extremes there is no close connexion between the factors, rainfall, temperature, humidity and the percentage of disease. It is thought, however, from evidence collected in 1946, that abnormally cold and humid weather may cause an increase in the disease.

That climate cannot be the only factor is shown by the fact that in some cases one field may be quite badly attacked whilst an adjacent field is practically free from disease. It is probable that such cases may be due to differences in the vigour of the crop, the diseased crop having been weakened by some such factor as overbearing, unsuitable soil, weeds, poor drainage, etc.

It was stated in the 1947 Report that individual plants showed great variation in their inherent resistance to the disease. This observation was carried further by a study, over a period of three months, of 148 clones planted in a single plot at Ol Joro Orok. (These clones are derived from single plant selections made before the bud disease first appeared and were not, therefore, originally selected for disease resistance.) The soil conditions appeared to be even within the plot and other factors, such as climate and cultural treatment were identical for all plants. Yet the degree of infection between clones varied from less than one diseased bud per 100 flowers to more than 40. The data were analysed and the following conclusions drawn:—

1. Resistant plants tend, at the same time, to be the best yielders. Susceptible plants would generally have yielded poorly even if all their buds had developed into normal flowers.

2. The high toxic strain (14 by 24) was significantly more resistant to the disease than ordinary pyrethrum. The average infection for 66 of the (14 by 24) selections was 4.7 per cent as compared with 7.2 per cent for 82 selections from ordinary pyrethrum.

3. The (14 by 24) selections, all being individuals from a single cross, showed less variability in their resistance to the disease than did the selections taken from fields of ordinary pyrethrum.

4. There was no evidence that very diseased plants were a danger to their more healthy neighbours. Diseased and healthy plants were distributed at random throughout the area and the disease did not spread out from the centres of infection.

The results of these trials reaffirm the value of plant breeding in overcoming the disease. It would not appear necessary for growers to uproot badly diseased plants so as to lessen the spread of infection, though it would be very important that such plants were not used for planting material.

The trial for testing the effect of time of cutting back was carried on for the second year but yielded little fresh information.

Other Pests and Diseases.—Beyond the usual cases of eelworm and thrips which occur to some extent every year, no instance of pyrethrum being attacked by a pest was observed.

There were a few cases of root rot and of flower disease other than bud disease.

A small trial was made to test the effect of a proprietary preparation on the control of eelworm. This experiment is not yet complete.

Weed-Killers

The Senior Agricultural Chemist gave an account of some trials on pyrethrum at the Scott Agricultural Laboratories in the 1946 Annual Report. It was found that Methoxone dust (M.C.P.A.) was relatively ineffective, even at 4 lb./ac., but liquid Methoxone gave a stronger reaction. Weedone (D.C.P.A.) applied as a spray had a drastic effect on pyrethrum even at a rate of 1 lb./ac.

The Scott Laboratories, situated at an altitude of about 6,000 ft., is not well suited to pyrethrum and as there was some evidence that pyrethrum was more tolerant of weed-killers at higher altitudes, it was decided to make further trials at Ol Joro Orok (7,800 ft.) and Molo (8,300 ft.).

Methoxone in both liquid and dust form was applied to pyrethrum at various rates ranging from $\frac{1}{2}$ to 4 lb./ac. It had little effect on the pyrethrum but as it did not kill the weeds either, the trials were abandoned.

Dinitro-ortho-cresol (D.N.O.C.) was also tried as a dust and as a spray at rates varying from 5–8$\frac{1}{2}$ lb./ac. At the higher rates, the foliage of the pyrethrum was scorched but the plants were not killed. It is possible that D.N.O.C. might be used for killing some kinds of weeds but it does not seem likely that it could be used in pyrethrum without giving the crop a setback.

D.C.P.A. was tested in the form of an ester (Weed-No-More). This was tried at Ol Joro Orok at the rate of 1, 2 and 4 lb. per acre. The pyrethrum appeared far more tolerant in these trials than in the Scott Laboratories trials, but subsequent tests showed that the crop varied considerably in its reaction to the weed-killer, even at high altitudes. Even where the plants did not appear to have suffered severely, it was found that spraying caused a marked decrease in pyrethrins content. Thus the flowers picked from a plot at Ol Joro Orok one month after receiving an application of Weed-No-More at the rate of 1 lb. per acre, had a content of only 0.90 per cent as compared with 1.76 per cent for the untreated control.

Although it is possible to kill weeds in pyrethrum with Weed-No-More, yet the risk of damaging the plants or destroying the pyrethrins and the high price of the product make it unlikely that this method will prove suitable for general commercial use.

General

P.A.R.A.C.—The Pyrethrum Agricultural Research Advisory Committee met four times during the year. Acknowledgments are gratefully made for their advice and assistance.

A booklet was prepared by the committee entitled "The Preservation of Pyrethrins" and this was published by the Pyrethrum Board.

Advisory Work.—Farmers' Days were held at Molo and Ol Joro Orok in October.

Exhibits were shown at the "Country comes to Town" exhibition in January and at the Nakuru Show in October.

Eleven articles were published dealing with various aspects of pyrethrum growing.

Four talks were given at growers' meetings.

Seventy-three visits were made to farms in connexion with advisory work.

E. W. GADDUM,
Agricultural Officer (Pyrethrum).

APPENDIX

Meteorological Records

Molo

Month	Rain	Humidity per cent 8.30 a.m.	Max. Mean °F.	Min. Mean °F.
	In.			
January	0·05	60	72·2	42·0
February	0·27	67	74·4	41·9
March	2·41	70	71·8	44·5
April	7·40	79	70·2	45·4
May	3·97	80	69·2	46·0
June	5·14	83	65·9	44·8
July	9·82	85	64·2	44·6
August	8·14	75	65·6	43·3
September	4·68	74	68·1	42·6
October	3·39	74	72·3	44·0
November	1·62	83	66·8	45·8
December	2·25	82	66·7	46·3
	49·14	76	69·0	44·3

Ol Joro Orok

Month	Rain	Humidity per cent 8.30 a.m.	Max. Mean °F.	Min. Mean °F.
	In.			
January	0·00	64	74·6	41·5
February	0·21	60	76·5	42·6
March	1·86	67	73·9	44·2
April	3·90	75	72·9	45·6
May	3·69	76	71·0	44·7
June	4·71	84	67·9	43·7
July	6·67	96	65·6	44·7
August	6·79	83	66·1	43·9
September	2·51	77	69·6	42·6
October	2·59	76	70·5	43·0
November	2·71	77	67·1	44·2
December	0·80	74	68·9	44·1
	36·44	76	70·4	43·7

Subukia

Month	Rain	Humidity per cent 8.30 a.m.	Max. Mean °F.	Min. Mean °F.
	In.			
January	0·03	54	75·7	45·6
February	0·60	53	77·9	50·3
March	1·10	56	77·2	51·1
April	5·75	66	75·6	50·1
May	7·66	72	72·3	50·5
June	7·47	76	70·3	50·2
July	4·21	75	69·6	49·5
August	9·32	75	69·8	48·8
September	4·87	71	72·4	47·2
October	5·52	73	72·3	47·4
November	1·74	76	68·5	48·2
December	1·86	71	72·5	48·5
	50·13	68	72·8	49·0

ANNUAL REPORT OF THE AGRICULTURAL OFFICER (SISAL), 1948

Staff

European.—Officer in Charge, A. F. Nichols, Agricultural Officer. Temporary Assistant Agricultural Officer, K. Lerche.

African.—One clerk, eight Field Assistants.

Advisory Work

There has been an increasing number of visitors, both local and overseas, to the station and it is gratifying to be able to record a growing interest in the work of the station. There has also been an increased number of visits of officers from the station to sisal estates. Every opportunity has been taken to discuss a variety of problems with growers.

High Level Sisal Research Station, Thika

Meteorological.—The rainfall for the year was below the average due to failure of the long rains with the paradoxical result that the long rains precipitated less than the short rains.

The rainfall for the year was:—

	Inches
January	*Nil*
February	0.27 in 2 days
March	2.35 in 9 days
April	6.50 in 13 days
May	1.34 in 6 days
June	1.15 in 7 days
July	0.29 in 3 days
August	0.08 in 4 days
September	*Nil*
October	4.18 in 6 days
November	5.56 in 13 days
December	7.63 in 15 days
Total	29.35 in 78 days

The average rainfall for the eight years 1941–1948 is 33.57.

Land Preparation.—During the year, four acres of old sisal were cleared and prepared for replanting and about 20 acres of virgin land were cleared of bush ready for breaking in 1949.

Sale of Fibre.—Several abandoned demonstration plots were cut and together with the leaves from the trials yielded during the year a total of about 18 tons of fibre which was sold locally to Sisal Products, Ltd., Ruiru.

Buildings.—The building programme which absorbed a great deal of officers' time progressed satisfactorily during the year. The house for the Assistant Agricultural Officer was completed in June and the foundation for the house of the second Assistant Agricultural Officer was prepared.

Eight four-roomed stone houses thatched with papyrus were built, thus completing the permanent labour lines at the station. A much-needed garage for lorries, implements, tractors, etc., was also completed, together with a lock-up store and workshop.

Fruit Trees.—A small nursery of fruit trees and forest trees was started for the station in the beginning of 1948 and with the great interest several growers have shown in this work it is being extended to meet the needs of sisal growers. As this work will only be undertaken in the few periods when boys can be spared it is obvious that this service will be restricted.

Small plots of grasses and cover crops have been planted in an endeavour to find plants that may be suitable for fallowing periods and inter-row cultivation.

Investigational Work in Progress

High-level Sisal Research Station.

Cutting Trial.—According to the programme for this trial it was cut in February and August, and the number of cuts made to date now vary between three and nine, depending on the intervals between cuts.

Several plots have poled and pole cuts have been taken where the plants could not be left for the normal cutting cycle without losing leaf. The number of leaves cut varies between 180 and 210 with 12 or 36 leaves left on the unpoled plants according to the cutting intensity. It would be misleading, if not dangerous, to draw conclusions at present from the yield figures, which vary from 4.9 to 6.3 tons per acre of unbrushed fibre while poling percentage varies from *nil* to 98 per cent.

A visual inspection of the trial will be more convincing than figures but certain trends can here be indicated always keeping in mind that no conclusive results can be published till the last plant in the trial has poled out.

The indications so far are that early and frequent cuts will delay poling and as each plant will produce a limited number of leaves this delay does not seem to be a feature to be aimed at. An early cut may be advocated for reasons of convenience of cleaning, and combined with light cuts, the plants appear not to suffer but may even produce a large number of leaves. A six months' interval has, however, been found to be too short in this district. Heavy cuts, especially when combined with short intervals between them, have a depressing effect on leaf production and yield. It must be remembered that the differentiation between light and heavy cuts indicates leaves left per plant after cutting, i.e. 36 and 12 respectively, and has got nothing to do with the number of leaves cut off the plant. In other words, one may, on one plant, cut off ten leaves and give it an extremely heavy cut by leaving only a few and on another, cut off 40 leaves and only give it a light cut, all depending on the number of leaves on the plant before cutting. That the plant benefits from being left with at least 36 leaves is clearly indicated at the station, and by ascertaining the growth rate in the different districts one should get an idea of the optimum frequency of cutting.

Spacing Trial.—The spacing trial was cut for the fifth time in September, when 7½ years old.

Here poling varies between 20 per cent and 100 per cent from the highest to the lowest population per acre and the final results should come to hand within a couple of years and till then no complete results can be obtained.

Some indications are, however, clear.

Although individual plant performance in heavily populated areas does not compare favourably with individual plants from wider spacings, there can be no doubt that where high fibre yields is the object, high populations are essential.

What the optimum population is likely to be is difficult to say as it is closely related to soil and rainfall. The trial shows, however, that, other factors being equal, the yield increases with population at least to the point of our maximum population of 2,178 plants per acre planted 10 ft. by 2 ft. Comparisons

have been made between individual plants spaced 15 ft. by 4 ft. and 15 ft. by 2 ft. and between 11 ft. by 4 ft. and 11 ft. by 2¼ ft. These show that the more crowded the plants are in the row the slower the development of the plant.

As population is needed for high yield and space between plants is needed so as not to delay development, and as mechanical cultivation sets a certain low limit to the distance between rows it is likely that growers will in future have to adopt double-row spacing although it is not liked at present in Kenya.

Weeding and cutting in double-row spacing is more difficult than in single-row, but it is possible to cut areas in which generation after generation of sisal has grown into an impenetrable mass. It therefore seems reasonable to assume that it would be possible to get labour to deal with well-tended double-row spacing. It must also be remembered that higher yields per acre greatly reduce costs of production.

It may be possible to extend the use of small tractors for inter-row cultivation and by this means to maintain a high standard of cultivation and to reduce the distance between rows. To achieve this object land preparation must be thorough before planting. The varying soil types, which obtain in the widely scattered sisal areas in Kenya, will probably require different treatments and it is hoped that the external trials will provide useful information on this subject.

Manurial Trial for Nurseries.—With the recognition of the value of good sturdy planting material and realizing that rapid initial growth implies that the number of leaves too small for cutting is reduced to a minimum, the object of this trial has been to achieve rapid growth in the nurseries with materials easily obtainable on any sisal estate.

To test the effect of spacing, the trial, which is a 6 by 6 Latin square design, was laid out in split plots of 2 ft. by 9 in. and 1 ft. by 9 in.

The manurial applications were of well-rotted sisal waste at 18 tons per acre, ash at 1½ tons per acre, sulphate of ammonia at 300 lb. per acre, applied alone and in all their combinations.

The trial was planted in November, 1948, and results will be to hand as soon as the plants are deemed ready for transplanting. The effect of manuring was noticeable as early as two months after planting.

External Trials.

Cultural Trials.—Four field trials were laid out during 1948 outside the station.

One on the black cotton soil of the Ruiru district was ridged and planted in March. The second was planted on the flat in the Trans Nzoia district in April. To ascertain whether any benefit could be gained by ridging this soil, a subsidiary plot of ridging versus flat was laid down. The third trial covers the Nakuru district and was planted in October on a marginal soil of rather low fertility. As there was a hard pan about 10 in. below the surface, the area was subsoiled and it was ridged to conform with the normal practice in the district. A subsidiary plot to investigate flat planting, ridging, subsoiling and combinations of the three methods was laid down and it is anticipated that very useful information will be obtained on the subject of land preparation.

The fourth trial, which covers the red soils of the Thika district, was laid out in November and planted on the flat.

The design of the layout for the external trials is a 3^4 factorial experiment arranged in a 9 by 9 quasi-Latin square. The four factors are (1) spacing of rows with 11 ft. and 14 ft. between double rows, which are themselves 3 ft. apart, (2) plant density with 1,200, 1,600 and 2,000 plants per acre, (3) earliness of cutting with the first cuts being made at three, four and five years after planting, and (4) frequency of cutting with intervals of six, twelve and eighteen months between cuts.

Banding Disease.—In February, 1946, a manurial trial was laid out on an estate in the Fort Hall district to find ways and means of combating banding disease. The manurial applications were lime, magnesite and dolomite at the rates of one and two tons per acre. After two years no improvement resulted from the applications of these fertilizers.

Samples of leaves and soil were sent to the Macaulay Institute in Aberdeen where it was found that the potash content of the soil and leaves from healthy areas was about five times as much as that from unhealthy areas. The assumption that the disease was due to a potash deficiency in the soil was confirmed by manurial experiments in Tanganyika. The application of potash will be made on the affected areas when suitable fertilizers can be obtained.

The appearance of banding disease and other nutritional abnormalities is a clear indication that soil exhaustion has reached an advancing stage in some areas. It is therefore clear that the use of commercial fertilizers and the return of sisal waste to fields will have to be undertaken if sisal growing is to be continued on an economic basis.

Acknowledgments

There was an increasing amount of travelling during the year and the staff of the station is greatly indebted to growers for their hospitality.

Sisal, Ltd., and B.E.A. Planting Co., kindly rendered assistance in the brushing and baling of fibre produced at the station, and Anglo-French Sisal Estate with workshop facilities.

A. F. NICHOLS,
Agricultural Officer (Sisal).

ANNUAL REPORT OF THE SENIOR SOIL CONSERVATION OFFICER, 1948

Staff

European—General.

Mr. A. C. Maher, Senior Soil Conservation Officer, proceeded on overseas leave to England on 25th February, 1948, and returned to duty at Kitale on 14th October, 1948.

Mr. R. O. Barnes, Senior Soil Conservation Engineer, acted as Senior Soil Conservation Officer during Mr. Maher's absence.

Mr. C. F. Newton, Assistant Soil Conservation Officer, Grade I, was promoted to Senior Assistant Soil Conservation Officer with effect from 1st January, 1948.

Mr. J. E. Hingston, Assistant Soil Conservation Officer, Grade I, was transferred to the Veterinary Department with effect from 1st January, 1948.

New Appointments.

Mr. G. W. R. Boorer was appointed as Assistant Soil Conservation Officer/Inspector on 21st February, 1948, and after training in the Eldoret district was posted to Thomson's Falls as Inspector on 6th July, 1948.

Mr. P. A. de la Pasture was appointed as Assistant Soil Conservation Officer, Grade I, on 24th March, 1948, and posted to Kitale.

Mr. W. F. Fawcett was appointed as Assistant Soil Conservation Officer, Grade II (Mechanical) on 1st June, 1948, and posted to Kitale.

Mr. S. H. Scott was appointed as Assistant Soil Conservation Officer/Inspector on 15th July, 1948, and after training in the Uasin Gishu district was posted to Lumbwa as Inspector on 22nd November, 1948.

Mrs. P. M. Benham was appointed as Temporary Clerk at Thomson's Falls District Headquarters on 2nd February, 1948.

Miss R. Powell was appointed as Temporary Clerk at Kitale Headquarters on 21st January, 1948.

Mrs. E. E. Clutterbuck was appointed as Temporary Clerk at Kitale Headquarters on 1st October, 1948.

Mr. N. M. Walsh was appointed as Assistant Soil Conservation Officer, Grade I, and joined the service after completing the long course at the Egerton School of Agriculture on 8th November, 1948.

Resignations.

Mr. J. D. Sullivan, Assistant Soil Conservation Officer, Grade II (Mechanical), resigned from the service on 13th August, 1948.

Mr. S. S. Brugh, Assistant Soil Conservation Officer, Grade I, left the service on completion of the long course at the Egerton School of Agriculture on 8th November, 1948.

Miss R. Powell, Temporary Clerk, resigned from the service on 21st February, 1948.

Mrs. E. Skelton, Temporary Clerk, resigned from the service on 31st December, 1948.

Egerton School Courses.—Messrs. H. C. L. Farrar, D. J. W. Foottit, S. S. Brugh, W. L. Hitchings, M. H. Sturt and W. F. Rendall attended the long course at the Egerton School of Agriculture from 23rd February, 1948, to 8th November, 1948. Messrs. P. A. de la Pasture, P. E. J. Dormer and H. D. Wilderspin attended the short course from 15th November, 1948, to 11th December, 1948.

General.—The European staff position at the end of the year was as follows:—

Senior Soil Conservation Officer	1
Senior Soil Conservation Engineer	1
Assistant Soil Conservation Engineer	1
Senior Assistant Soil Conservation Officer	1
Assistant Soil Conservation Officers, Grade I	13
Assistant Soil Conservation Officers, Grade II	2
Assistant Soil Conservation Officers/Inspectors	5
Assistant Soil Conservation Officers, Grade I (Mechanical)	3
Assistant Soil Conservation Officer, Grade II (Mechanical)	1
Accountant	1
Clerical Staff	4
	33

The following officers were in charge of districts during the year:—

Trans Nzoia: Mr. M. Kerfoot.

Uasin Gishu: Mr. G. E. Goby.

Nyanza: Mr. G. H. Dukes.

Nakuru: Mr. C. F. Newton.

Thomson's Falls: Mr. N. G. Glynn.

African Staff.—During the year the following numbers were engaged and/or discharged:—

Artisans.	*Engaged*	*Discharged*
Carpenters	9	7
Masons	—	3
Mechanics	2	3
Signwriters	1	—
Others.		
Camp Boys	29	15
Clerks	—	—
Herdmen and Oxen Drivers	1	1
Instructors	—	—
Labourers	236	180
Levellers	6	2
Lorry Drivers	3	3
Office Boys	—	—
River Scouts	1	1
Staff Boys	—	5
Storekeepers	—	—
Terracers	2	11
Tractor Drivers	1	5
Watchmen	2	5
Total	293	241

The number of African staff employed at the end of the year was as follows:—

Artisans.

Carpenters	18
Masons	9
Mechanics	4
Signwriters	1

Others.

Clerks	7
Camp Boys	56
Instructors	1
Herdmen and Oxen Drivers	5
Levellers	47
Lorry Drivers	19
Labourers	235
Nurserymen	3
Office Boys	2
River Scouts	33
Staff Boys	50
Sweepers	1
Terracers	78
Tractor Drivers	38
Turnboys	3
Watchmen	12
Total	622

Visits

Mr. Maher, Senior Soil Conservation Officer, returned from overseas leave in October, 1948. On 26th October he attended a meeting of the Nandi Tea Growers at Siret Estate, Songhor. From 2nd to 20th November he was in the Belgian Congo where he and Mr. Gethin Jones represented Kenya Colony at the Pan-African Soil Conference at Goma. In December Mr. Maher visited Nakuru and Thomson's Falls District Headquarters and the Dam Construction Unit at Machakos. He attended, with Mr. Barnes, a meeting held in Nairobi under the Chairman of the Water Resources Board on 17th December and afterwards visited the Kinangop on drainage schemes. He left at the end of December to visit the ground-nut scheme in Tanganyika Territory.

Mr. Barnes, who acted as Senior Soil Conservation Officer during Mr. Maher's absence on overseas leave, visited Eldoret, Lumbwa, Kinangop, Naivasha and Thomson's Falls districts during March, in connexion with drainage work, etc. He also visited tea estates at Kericho and in the Nandi area. In April and June he visted the Machakos area to inspect possible dam sites, and also visited the Nakuru, Nairobi and Thomson's Falls areas during June. During the third quarter of the year Mr. Barnes was on *safari* for 47 days in connexion with dam construction work in the Thomson's Falls and Machakos areas and on general soil conservation work in the Eldoret, Lumbwa and Njoro districts, and he also visited Kisumu to advise the East African Railways and Harbours on erosion problems. In October, after the return of Mr. Maher, Mr. Barnes attended the meeting of the Nandi Tea Growers on the 26th, and then visited Nairobi and the Dam Construction Unit at Machakos, afterwards visiting Thomson's Falls and Njoro. He paid further visits to Gilgil, Kisumu, Nakuru, Nairobi and Machakos, and attended the meeting of the Water Resources Board at Nairobi on 17th December.

Messrs. Kerfoot, Glynn, Goby, Brook and Evans attended a meeting of Assistant Soil Conservation Officers in charge of districts at Njoro from 19th to 22nd July.

Inspectors from all areas attended a conference of Inspectors under the Land and Water Preservation Ordinance held by the Senior Agricultural Officer, Rift Valley Province, at Njoro on 5th and 6th October.

Visitors

The Hon. Chief Secretary, Mr. J. D. Rankine, together with the Secretary of the Development and Reconstruction Authority, Mr. C. M. Deverell, and the Provincial Commissioner, Mr. D. Morgan, visited Kitale in January and saw Soil Conservation Headquarters and soil conservation work in the Trans Nzoia district.

Mons. G. Tondeur, Chef du Mission Anti-Erosive au Congo Belge, and Dr. R. Guyaux, Provincial Veterinary Officer, Costermansville, Belgian Congo, visited Kitale in February and saw the experimental grass plots and soil conservation work in the district. They also inspected soil conservation work in the Uasin Gishu, Nakuru and Thomson's Falls areas.

Mr. J. T. Moon, Senior Agricultural Officer, Central Province, with Mr. G. Cowley, Agricultural Officer, Machakos, and Mr. J. Balfour, Settlement Officer, Makueni, visited Kitale Soil Conservation Service Headquarters in May. They saw soil conservation work in the Trans Nzoia district and inspected the experimental grass plots at the soil conservation service camp.

Mr. Leyden, Economic Liaison Officer to the Colonial Office, visited the Soil Conservation Service farm and district work of the Soil Conservation Service at Kitale on 7th November.

Forty Suk chiefs and headmen visited the Soil Conservation Service farm at Kitale on 12th November.

Professor Cerighelli, Professor of Tropical Agronomy (France), and M. Cours, Chief of the Division of Agronomic Research, Madagascar, visited soil conservation work in the Njoro area on 2nd December.

Miscellaneous Work

The attached Table No. I summarizes the work done in European areas during the year. It will be observed that, compared with 1947, there was a considerable increase both in acreage terraced and miles of terracing carried out, while the number of farms on which terracing was carried out increased from 95 to 123. A considerable increase is also shown in the length of farm road constructed during the year.

Machinery

The workshop for the Trans Nzoia and Uasin Gishu districts was transferred from the old K.A.R. lines in Kitale to the Soil Conservation Service camp during March. This centralization greatly facilitated the work of the mechanical staff although there was difficulty in finding housing for African drivers, mechanics, etc., as the programme for permanent African quarters at Kitale is still far behind requirements.

Mechanical work in the Nakuru, Thomson's Falls and Nyanza districts continued to be done under some difficulty in the temporary workshop at the Soil Conservation Camp at the Plant Breeding Station, Njoro. More satisfactory arrangements could not be made owing to the expectation that the new headquarters for the Nakuru district will be built outside Nakuru, including a permanent workshop.

The Dam Construction Unit became almost entirely self supporting as regards repairs during the year with the addition of a mobile workshop and a mobile arc-welding set.

The following additions were made to the machinery of the Soil Conservation Service during the year:—

Conservation Machinery.

2 International T.D. 18 tractors (on loan from A.L.U.S.B.).
1 Caterpillar D. 4 tractor.
1 Le Tourneau cable-operated angledozer.
1 22 cu. ft. Killefer rotary scraper.
1 No. 1 terracer.

Farm Machinery.

1 Chain harrow.
1 Mower for Farmall tractor (International).
1 Three-furrow plough for Farmall tractor (International).
1 Two-row maize planter (International).
1 Three-h.p. engine and pump for water tank.

At the end of the year the machinery position was as follows:—

Conservation Machinery.

1 Cletrac tractor.
5 Caterpillar D. 6 tractors.
2 International T.D. 14 tractors (one on loan).
2 International T.D. 18 tractors (with Bucyrus Erie angledozers) (on loan).
6 Angledozers—
  1 Le Tourneau at Kitale.
  1 La Plante Choate hydraulic at Eldoret.
  1 Blaw Knox hydraulic at Kitale.
  1 La Plante Choate at Thomson's Falls.
  2 Bucyrus Erie at Njoro with T.D. 18 tractors.
1 Le Tourneau rooter.
1 22-ft. Killefer rotary scraper.
3 Hummer graders.
10 No. 1 terracers.
3 No. 22 terracers.
6 No. 2 terracers.
1 Blaw Knox Sheepsfoot roller.

With Dam Construction Unit.

3 Caterpillar D. 7 tractors.
1 Le Tourneau W. 2 Sheepsfoot roller.
1 Blaw Knox hydraulic angledozer.
2 Le Tourneau cable-operated angledozers.
3 Double drum power controls.
2 Le Tourneau rooters.
3 Le Tourneau Carryall scrapers.
1 Albion tank transporter.

Farm Machinery.

1 International Farmall "M" tractor.
3 Disc harrows—1 Double Baronet, 1 International, 1 Single Ox.
1 International hammer mill.
1 Three-h.p. engine for water pump.
1 Ransome maize sheller.
1 John Deere manure spreader.
1 Three-h.p. engine for water.
1 International maize planter.
1 International 16-H.M. power take-off mower.
1 International two-row cultivator.
8 Cultivators.
1 Chain harrow.

Hours Worked by Tractors and Running Costs.—Although some of the tractors are getting very old the total hours run by these machines, particularly in the Uasin Gishu and Trans Nzoia districts, reflects great credit on the mechanical staff. The attached Table No. II shows hours run by tractors in the possession of the Soil Conservation Service during the year, except where otherwise stated.

Vehicles

The following new vehicles were received by the Soil Conservation Service during the year:—

1 Ford ½-ton L.D.V.

2 Chevrolet sedan deliveries.

The vehicle position at the end of the year was as follows:—

2 Dodge 3-ton lorries.
2 Ford 3-ton lorries.
2 Chevrolet 3-ton lorries.
1 Ford 1-ton truck.
1 Ford 2-ton truck.
10 Ford ½-ton L.D.V.s.
2 Chevrolet sedan deliveries.
1 Dodge panel van.
1 Ariel motor-cycle.
10 Caravans (8 with S.C.S., 2 with Dam Construction Unit).
1 Dodge 3-ton lorry with Dam Construction Unit.

Dam Construction Unit

The Dam Construction Unit was working in the Thomson's Falls area from the beginning of the year until the end of September. Work was begun in the Machakos Reserve during October, but the first dam had not been completed at the end of the year due to considerable delay occasioned by the enforced use of an inferior slow-setting Belgian cement (at the time good cement could not be obtained). Continued rain at the end of the year from time to time prevented heavy machinery from being used on the black clay soil in the basin of the dam, while continual silting of the bed of the valley round the concrete cut-off walls caused additional loss of time. A total of 15 dams was constructed during the year compared with a total of 22 during 1947. Only 231,600 cubic yards of earth were moved compared with 281,000 cubic yards in 1947. However, the total of water impounded was considerably larger—1,340 acre feet or 364,000,000 gallons compared with 977 acre feet or 265,000,000 gallons in the previous year. The cost of earth movement remained very low although it was found that an underestimate had been made of the amount which should be allowed for spares and repairs, particularly in view of the heavy wear which is suffered by tracks on this type of work. Further, an additional amount has to be allowed in the way of "overheads" to cover the amount of idle time during which earth cannot be moved by the Unit due to unfavourable climatic conditions, breakdowns of machinery or delay caused by movement of machinery on rail. The staff of the Unit in fact worked a total of 211 days during a season's work at Thomson's Falls. (This did not coincide with the calendar year under review.) This number of days included 34 Sundays and public holidays which were worked during the completion of urgent work during the season.

The largest dam in quantity of water impounded which has hitherto been built by the No. 1 Dam Construction Unit was the dam constructed for Mr. N. P. Tucker near Rumuruti, which comprises 320.5 acre feet, which necessitated the movement of nearly 42,000 cubic yards of earth, which also is in excess of the quantity of earth moved for any other individual dam.

Terracing

The usual plaint of shortage of levellers has to be made for 1948. It is only when the expansion of secondary education in Kenya Colony has taken full effect that the requirements of the continually growing work of the Soil Conservation Service for secondary-educated Africans are likely to be kept pace with.

During the year large demands were made upon the Soil Conservation Service by tea estates in both the Kericho and East Nandi districts. It was found difficult to comply with some of the requests owing to the lack of levellers mentioned above. However, an Assistant Soil Conservation Officer, Mr. Hitchings, was posted for special work in the Nandi tea areas in December.

One question which is of increasing importance is that of the mechanization of minor earth-moving work such as is required in bringing terraces to grade. The increased wages and more expensive rations brings the cost of labourers up to over Sh. 2/50 a day and earth-moving by hand will soon cost in the neighbourhood of 75 cents a cubic yard. A trial was made with a Killefer rotary scraper which indicated that it should be possible to move earth mechanically while bringing terrace and ditch channels to grade at a price not exceeding 50 cents per cubic yard. Unfortunately, lack of track tractors of about 30 h.p. for carrying out this work has precluded this intention from being carried into practice. It is hoped that the new Fowler Mark V Diesel tractor, if one can be obtained for trial, will be found suitable for work of this nature. Ultimately it is hoped that a great deal of this kind of work which is necessary at present will be obviated by the removal of anthills and filling of hollows by D. 7 Caterpillar tractors equipped with angledozers prior to doing terracing work. The smoothing out of irregularities by angledozing not only facilitates terracing for erosion control but also assists the general cultural operations of small farm tractors.

Drainage

Good results were obtained on a farm at Fort Ternan during the second quarter of the year in reducing waterlogging by boring holes at the bottom of terrace channels with a post-hole auger. The holes were bored through the heavy clay subsoil until a more permeable stratum was reached. The holes were filled with broken stone. However, it was found that the holes were liable to become blocked with silt, and with soil during the usual operations of cultivation.

A trial was made on volcanic ash soil at Eburru to see whether the absorption of run-off water is increased by ripping with a heavy rooter. This was done on alternate terraces.

Mole draining was attempted with a Miles mole plough, which was received from England during the year, at the Ol Joro Orok Experimental Farm. It was found, however, that a D. 6 Caterpillar tractor did not have sufficient power for the job and the work was postponed until a more powerful tractor could be obtained. It appears probable that D. 8 Caterpillar Diesel tractors will be required for drainage work if this is to be carried out on a practical scale.

Towards the end of the year arrangements were made to mole-drain several acres on a farm at Fort Ternan (tile drain pipes having been obtained from the Public Works Department) and to try the effect of open drains 3 ft. deep on a 0.5 per cent grade in lieu of the usual type of terraces.

At the beginning of the year open drains 3 ft. deep with 1 : 1 side slopes involving the excavation of 1,959 cubic yards of earth were made on 0.5 per cent grades on Sussex Farm, North Kinangop (Mr. D. Lyall). These open drains were made as the preliminary operation in a mole drainage scheme covering 50 acres. It was not found possible to complete this scheme owing to the lack of drainage tiles during the early part of the year and delay in securing the Miles mole plough. However, these open ditches carried a good deal of water during the wet weather and so did a considerable amount of good to the land.

Surveys

In the last quarter of the year a survey was made of a 3,000 acre farm in the Trans Nzoia district belonging to the Earl of Portsmouth. A conservation and land use plan was prepared on the basis of the contour survey.

A plane table survey was made of a farm at Njoro with a view to replanning the roads and terracing system. On this framework the whole farm is to be worked on the contour and on a rotational system of farming.

A contour survey was made of 244 acres in the Thomson's Falls district and the survey of a further 500 acres was nearing completion at the end of the year.

Plans of a number of farms were made during the year by the Inspector in the Uasin Gishu district as a basis on which farm programmes could be prepared.

Inspection Services

Trans Nzoia.—The Inspector in the Trans Nzoia states that many of the new settlers declared themselves unaware of the requirements of the Land and Water Preservation Ordinance. While ignorance of the law is no defence it appears desirable for copies of the rules to be posted outside administrative offices and offices of the Department of Agriculture.

Two cases under the Land and Water Preservation Ordinance were given to the police during August and October for prosecution, but the cases had not been heard by the end of the year.

Thirty-three orders were served in respect of native cultivation and it was found necessary to cut down the crops on approximately ten acres of land under native cultivation which had been closed to cultivation by order.

During the year approximately 600 acres of European land were ordered to be terraced and this work was done by the Soil Conservation Service during the year. Approximately 160 acres of land under European cultivation were closed to cultivation by order, while 300 acres are being put back to grass by voluntary agreements.

The Inspector reports that many farmers have now planted bulking plots of grass to produce seed for grass leys. One farmer has sold over three tons of molasses grass seed and has an order from one estate for £750 worth of seed for 1949.

Nakuru.—The Inspector states that many farmers seem to have little understanding of methods of ploughing terraces and frequently only use one method. On many fields the banks and channels are too deep and a pronounced dead furrow can be seen in the centre of the land between terraces. He also says there is too little regard for drainage ways and terrace outlets and little appreciation of the requirement of handwork every year to remove minor defects in terraces.

In pyrethrum fields the capacity of terraces is usually fair and the general maintenance is fairly good. Where pyrethrum has been ploughed up, however, difficulty is being experienced in improving the terraces before planting other crops and in some cases such terraces are being almost lost.

The Inspector remarks on the great tendency for fields to be too large, to be cultivated for too long a period, and when allowed to revert to fallow not to be planted to useful grass.

Contour cultivation seems to be becoming more popular and the districts as a whole are beginning to realize the need for leaving natural drainage ways under grass, especially where there are considerable blocks of cultivation.

The Inspector considers that squatters can only be persuaded to keep to the land allotted to them by a system of fining them for planting other than where they are permitted to do so and destroying crops. Terraces in the squatter *shambas* are generally visible but inadequate. Farmers are to blame for having too many squatters and therefore being unable to arrange a system of rotational land under squatter cultivation. Reafforestation and the planting of land with grass when squatter land is closed is very rare. Cultivation of river banks is on the wane, however.

With great help from the Forest Department a great deal of effort is now being made to align new logging roads and the deforestation caused in the past, says, the Inspector, is on the mend, but he considers that a strict watch must be kept, particularly on areas in which there are timber concessions.

Thomson's Falls.—Mr. G. W. R. Boorer was posted to this district in June, 1948. On arrival at Thomson's Falls he accompanied the Senior Agricultural Officer, Rift Valley Province, and the Agricultural Officer, Ol Joro Orok, on a visit to the Nanyuki–Naro Moru ranching areas in order to examine the condition of this land following the unsatisfactory grazing conditions which were reported upon by Mr. R. E. G. Ruck. It appeared that most of the grazing affected by overstocking and drought in 1946–1947 had made a remarkable recovery. A good cover of red oat grass was found on one of the worst-affected farms with little evidence of the ill treatment which had been previously reported.

During the period July–December activities were mainly confined to the wheat farms in the Ol Arabel Valley, in the Marmanet area and along the Trent Road, Aberdares. A systematic inspection on a farm to farm basis revealed only isolated instances of gully erosion but ample evidence of sheet erosion. Information received regarding crop yields of ten to twelve bags of wheat per acre showed that the average fertility of this wheat land is still high. However, little attempt is being made at soil conservation: ploughing up and down hill and the cultivation of drainage ways are all too common. The necessity for cultivation on the contour and the avoidance of ploughing across drainage lines was constantly emphasized. It was found necessary to close some 300 acres to further cultivation by official orders.

In the area under consideration, cultivation of land slopes over the local legal limit of 20 per cent is the rule rather than the exception.

Two River Scouts were posted to the Aberdares with the object of making a detailed survey of squatter cultivation. This survey disclosed a serious state of affairs and every effort is being made to clear labour from these undesirable steep slopes. Since this operation two farmers in the Aberdares district have requested assistance in removing their squatters.

Fines of Sh. 100 were imposed by the District Commissioner, Rumuruti, in four cases of flagrant contravention of Rule 8 of the Land Conservation Rules.

Uasin Gishu.—Prosecutions in this district for offences contrary to the Protection of Stream Banks and Stream Flow made under the Land and Water Preservation Ordinance brought in fines amounting to Sh. 2,083 during the year.

Twenty-two and a half acres of illegal squatter cultivation were destroyed in the Kipkabus area.

During the year the Inspector carried out a contour survey of the Experimental Farm of the Department of Agriculture at Eldoret to enable the Assistant Agricultural Officer to prepare a sound plan for the development of the farm.

Farm surveys were made on about nine farms and the Assistant Agricultural Officer prepared long-term farming programmes including suitable crop rotations and the use of grass leys.

Officers had been requested by the Soil Conservation Service to try and obtain seed of desirable pasture legumes and, on the direction of the Inspector, River Scouts collected several varieties of clover which are to be bulked up on the Experimental Farm of the Department of Agriculture.

Experimental planting of Napier grass (*Pennisetum purpureum*) and morning glory (*Ipomœa purpurea*) was made in a large gully in the Moiben Valley on the suggestion of the Senior Soil Conservation Officer.

Orders were issued to all farms in the Ol Dane Sapuk Valley, which is four miles from Eldoret, to protect the land in that area from erosion. All ploughed lands in this area are terraced.

Tree felling was forbidden in the Kaptagat Forest Reserve for a distance of 100 yards from all streams in the catchment area of the Eldoret water supply.

Nyanza.—Mr. S. H. Scott was posted to the European areas of Nyanza Province as Inspector under the Land and Water Preservation Ordinance on 22nd November, 1948. Due largely to giving assistance to the agricultural show at Kapkatet in December this officer did not get into full swing with his duties until after the end of the year.

S.C.S. Farm Land, Kitale

Ninety-one acres of maize were harvested at the end of the year. It is expected that the crop will amount to 1,100 bags or rather more than 12 bags per acre. The cost of production was estimated to be Sh. 184 an acre or approximately Sh. 15 a bag.

Maize is ground to flour on the farm with a hammer mill driven by the International Farmall "M" tractor, and distributed to other Soil Conservation Service District Headquarters.

The following acreages of crops were also grown for green manuring purposes, for stock food, or as rations for labour:—

Lupins	4 acres
Sunflower	7 acres
Cow peas	7 acres
Potatoes	3 acres
Mangolds	1 acre
Sweet potatoes	2 acres
Field peas	4 acres
Soya beans	1½ acres

The following grasses were grown as temporary leys, in bulking plots for seed production or for the issue of planting material, or in small trial plots:—

Molasses grass (*Melinis minutiflora*)	20.77 acres
Panicum makarikariensis	4.56 acres
Eragrostis curvula	2.04 acres

Sporobolus filipes
Eragrostis chloromelas
Eragrostis lehmanniana
Brachiaria brizantha
Setaria machrostachya
Paspalum scrobiculatum
Brachiaria soluta
Pennisetum glabrum
Digitaria horizontalis
Setaria longiseta
Bouteloua curtipendula
Trichachne californica
Digitaria swazilandensis
Digitaria gazensis
Panicum antidotale
Chloris gayana

} ⅛-acre plots for grazing trials.

At the end of the year a further 30 acres of veld grass were ploughed up for planting with molasses grass, Rhodes grass and other grazing grasses. Forty acres which were cropped with maize in 1948 are to be undersown with grass in 1949.

Five acres of young bananas were maintained during the year. This plot is to be increased in size in 1949 to provide bananas for rations.

Five acres of maize, principally maize which had been damaged by cock-chafer larvæ, were cut for silage in August.

One acre of mangolds was grown for dry-season food for the cattle while the area under elephant grass (*Pennisetum purpureum*) for green fodder was increased to six and a half acres.

Approximately seven acres of cow peas were planted at the end of October following sunflowers and grew well despite the rapid drying of the ground subsequent to planting.

About 2,000 yards of fencing were erected during the year.

The cattle herd was increased by seven culls, mostly grades of poor type and not considered fit for breeding purposes, transferred from the Agricultural Experimental Station, Kitale.

Artificial insemination was carried out on a few native cows—the cows mentioned above were chiefly sterile—and a small amount of milk was sold to African staff. A total of four calves were born during the year.

The cattle dip was completed in May and was in use throughout the year. There were no deaths from disease during the year but three oxen died from dip poisoning during July.

Camps and Buildings

The end of the year found the proposal to transfer Soil Conservation Service Headquarters to Nakuru little further forward beyond a borehole having been completed successfully for the use of the Public Works Department Road Construction Unit at Nakuru on the edge of the 150 acres which is intended later for the use of Soil Conservation Service Headquarters and Nakuru District Headquarters. This borehole is later to be handed over for the use of the Soil Conservation Service. House plots were pegged out on the plot but no buildings were carried out on these sites during the year.

Headquarters remaining at Kitale, it was necessary to make arrangements to house local and headquarters staff at the Soil Conservation Service camp as Kitale suffers housing difficulties no less than other townships. Two timber houses were built for European married quarters and three sets of quarters for single officers. Towards the end of the year a brick house was completed for the Assistant Soil Conservation Officer in Charge, Trans Nzoia District. Servants' quarters, latrines and kitchens were built for all houses but great expense and inconvenience has been suffered due to the necessity of carting water two and a half miles in drums by lorry. Hitherto it has not been possible to obtain the necessary 1¼-in. piping to connect up with the Kitale water scheme near the European school, as is proposed.

The following buildings were also completed at Kitale during 1948:—

Dispensary: 238 sq. ft.

Implement shed: open type covering 864 sq. ft.

Twelve mud and wattle rondavels.

Four temporary maize cribs (each to hold 250 bags).

By P.W.D.

Four type 4 African houses.

Nine type 2A African houses.

Five type 1 African houses.

Housing for African staff at Kitale was still a difficult question at the end of the year.

The septic tank and lavatories for African staff in the brick block of quarters built in 1945 were nearly completed by the end of the year.

One wooden house was built in sections at Kitale and erected at the Plant Breeding Station at Njoro for the use of the Assistant Soil Conservation Officer/Mechanical who is stationed at Njoro.

Buildings erected at other district headquarters were as follows:—

Eldoret.

By P.W.D.

Four type 4 African permanent houses.

Five type 2B African permanent houses.

Two single latrines.

Two double latrine/wash-houses.

One European economy house: (started 1947, completed April, 1948).

One office (five rooms).

One latrine.

One store (five rooms).

One semi-permanent garage (four bays).

By S.C.S.

One wooden hutment—two rooms, 12 ft. by 12 ft. (purchased from Gordhan Gopal & Sons and erected by S.C.S.).

One temporary latrine.

Lumbwa.

By S.C.S.

One workshop 64 ft. by 15 ft.: wattle, thatched roof, open sides. Two sections: one section 50 ft. by 15 ft. timber store; one section 14 ft. by 15 ft. carpentry workshop.

One hut, 12 ft. by 10 ft.: wattle, mud walls, earth floors.

Three semi-permanent huts, 28 ft. by 14 ft.: podo, shingle roofs. Two sections, 14 ft. by 14 ft. each.

Thomson's Falls.

By S.C.S.

One African recreation hall: cedar, shingle roof.

Two boys' quarters for European house: cedar, rubberoid roof.

Two temporary houses for African staff: cedar, shingle roof.

General

It will be seen that during 1948 there was a continued increase in the amount of terracing carried out by the Soil Conservation Service and that terracing work was done during the year on 123 farms. The rate of terracing, however, especially owing to the continued inadequacy of the number of tractors, is still far too slow in that it would probably take 50 years at the present rate of progress to cover the ground which should be dealt with; but this is on the assumption that all terracing is kept in good order and that it is not necessary to return to restore terraces the capacity of which has become reduced until they become ineffective. It is known that despite the efforts of Inspectors much work in fact is lost, especially where continued cultivation has reduced the structure of the soil to a powder which readily sheet-erodes and fills up the channels of terraces: nor is this the whole story. Of the 123 farms terraced only 13 farms or 10.6 per cent were terraced as part of a complete agronomic and conservation plan. Under

such a plan soil building rotations, including notably the use of grass leys, and general farming measures designed to increase the organic matter content of the soil are included so as to aid and support the mechanical structures by increasing the absorptive capacity of the soil and reducing the tendency to sheet erosion. The proportion planned in the various districts in which there is a district headquarters of the Soil Conservation Service is as follows:—

District	No. of Farms Terraced	No. Terraced as Part of Complete Plan	Percentage Planned in each District
Uasin Gishu ..	18	2	11·1
Nakuru	26	—	—
Nyanza	17	4	23·5
Thomson's Falls ..	23	6	26·1
Trans Nzoia ..	39	1*	2·6
	123	13	10·6

*In addition 5 farms were partially planned in the Trans Nzoia.

There are several reasons for the low proportion of farms fully planned in the various areas. In some districts there has been a shortage of agricultural staff, particularly of experienced staff who can work out suitable economic farming plans with the farmer. In some areas farmers have been content with the living they have been able to make by the methods which they have used for a considerable period although these methods may be open to criticism as being typical short-term exploitation farming policy. In some cases, of course, though the actual farming policy may not have been discussed with the farmer by the Government officers concerned, the farmer may have in fact a long-term plan which will be adequate not only to maintain yields but to safeguard or increase the fertility of the soil. It is to be feared, however, that there are more cases in which the continuance of an inferior type of husbandry on the farm will nullify the benefits of such mechanical work as has been done on the farm and therefore result in the wastage of both private and public funds.

There have been during recent months a number of articles and letters in the local Press suggesting that a system of individual land ownership including security of tenure would automatically remedy the deplorable conditions of soil destruction which are acknowledged to exist in many parts of the native reserves. If this were indeed the case it might be expected that there would be little of which to complain on European-owned farms which are either individually owned or at any rate are occupied on a long lease of 99 or, more frequently, 999 years which is a sufficiently close approximation to freehold tenure. In no conventional sense of the term it is sad to relate that the situation is far otherwise. Many of the longest established settlers betray a disregard for the future of the land which bears witness either to their cynicism and selfishness, to their ignorance or to their feeling of impermanence. Farmers are judged too frequently by the community merely on financial results. A man who can sport a new saloon car, who can send his children to Europe for education or who can make frequent visits to Europe on holiday is assumed to be a successful farmer; but he may be leaving a bitter heritage for the future generations, undermining the material foundations of white settlement in East Africa. Frequently a European farmer has had the good fortune to enter upon virgin land with high intrinsic fertility. By reasonable attention to such elementary principles as early planting, clean cultivation and good seed he has been able to make a very favourable profit from his farm, particularly in periods of rising prices when costs of production are apt to lag behind the price of cereals. Some farmers enjoy private

incomes. It cannot be invariably assumed by any means that these farmers will necessarily give a greater amount of respite to the land. Arable cropping is sometimes continued on a farm, particularly for cereals, for periods as long as 20 or 30 years without any time being given for fertility to be restored under a grass fallow. Considerable gullies may appear but are ploughed across so that they are not so noticeable at the beginning of the season, and decreasing yields are attributed to any cause but that of deteriorating soil. Some farmers—individual owners and supposedly permanent settlers—will avow openly and cheerfully that after a few more years of exploitation they hope to sell their farms at a high price to some unsuspecting newcomer who lacks the knowledge or experience to appraise the amount of deterioration which has occurred. In part it must be admitted that, due to a financial policy under which the Department of Agriculture has been unable to maintain sufficient experimental work during the past quarter of a century, officers of the Department of Agriculture may not feel always on entirely safe ground in making proposals for agronomic and economic reorganization of the business of a farm. It must be stated, nevertheless, that there are a few notable farmers in various parts of Kenya Colony whose energy and ability and their appreciation and practice of the most up-to-date scientific principles of farming would make them outstanding in any part of the world.

Again a large number of the new settlers have an awareness of the necessity of safeguarding and building up soil fertility and a desire to start and continue their farming operations on the best possible lines which ought to (but will not) set an example to many of the old "practical" farmers whose experience has largely consisted of ploughing and planting cereals for 20 to 40 years.

There has indeed come a wide acceptance of the need for some mechanical methods of diverting and controlling the excess run-off water which is liable to cause such disastrous damage to the soil during the occasional downfalls of intense rain which are experienced in most parts of Kenya Colony. It is not equally widely appreciated that the building of terraces and diversion ditches is only a part, and frequently only a very small part, of the changes which are necessary to protect and if possible to increase the productivity of the farming land in the European areas of Kenya. Until farmers generally are able to appreciate more clearly what is required for good husbandry in Kenya the Soil Conservation Service and the Department of Agriculture generally will continue to fight a losing battle, though the period over which the battle will be fought will vary in different districts according to the inherent fertility and resistance to erosion of the soils concerned. It has been stressed very often by the Soil Conservation Service that soil conservation is not only a technical matter but very largely an economic question. It is impossible to conserve the soil if a farmer continues to exploit, sometimes perforce, that part of his capital which lies in the soil. Maybe he hopes to cash in on existing fertility to support development of his farm, to educate his children, to pay for passages to Europe or even to supply his bare living costs. There is a limit, however, to the extent to which fertility may be exploited and land abused without it becoming impossible to restore the soil later to a state even as good as it was in the first place; and the using up of reserves of fertility during a period of high prices for farm produce is a policy which may have very damaging results should a period of deflation occur in a few years' time.

COLIN MAHER,
Senior Soil Conservation Officer.

TABLE I

TABLE OF WORK DONE BY THE SOIL CONSERVATION SERVICE DURING THE YEAR 1948

District	Broad Base and V Terracing			S.C.S. Tractors		Narrow Base T.	Bench Ter.	Roads	Excavation C. ft.		Train Banks	Outlet drains		Cut-off drains	
	Acres	Miles	Farms	Acres	Miles	Acres	Acres	Yards	S.C.S. Labour	Farm Labour	Yards	Yards	Cusecs	Yards	Cusecs
Trans Nzoia:															
1st quarter ..	823·40	93·93	13	401·57	40·11	—	—	5,034	30,054	80,184	—	15,007	2,287	19,500	2,266
2nd quarter ..	318·99	38·49	9	149·75	26·37	—	—	7,951	105,745	17,112	—	166	10	8,283	1,292
3rd quarter ..	504·06	38·42	5	250·73	18·00	—	—	5,365	2,185	22,486	—	2,192	205	1,334	125
4th quarter ..	1,189·74	120·64	12	532·20	59·72	—	—	24,419	107,205	93,466	—	15,486	1,937	2,566	195
TOTAL ..	2,836·19	291·48	39	1,334·25	144·20	—	—	42,769	245,189	213,248	—	32,851	4,439	31,683	3,878
Nakuru:															
1st quarter ..	1,108·60	107·30	5	570·60	60·40	—	—	16,427	36,600	—	10,527	—	—	2,183	443
2nd quarter ..	867·30	93·80	15	798·30	84·50	4·8	23·0	4,858	36,709	—	11,806	—	—	4,747	816
3rd quarter ..	—	—	—	—	—	—	14·7	—	17,327	—	15,377	—	—	18,182	1,350
4th quarter ..	884·00	83·10	6	592·80	64·90	—	3·0	8,220	—	24,550	9,880	370	75	2,404	339
TOTAL ..	2,859·90	284·20	26	1,961·70	209·80	4·8	40·7	29,505	90,636	24,550	47,590	370	75	27,516	2,948
Nyanza:															
1st quarter ..	410·01	58·44	7	297·01	42·14	—	—	1,333	776	747	—	1,492	273	983	120
2nd quarter ..	482·84	84·71	5	423·63	72·90	—	—	1,587	895	4,702	—	1,551	305	167	130
3rd quarter ..	18·02	3·65	2	12·00	2·35	—	—	—	—	4,453	—	500	57	—	—
4th quarter ..	100·74	15·61	3	85·41	12·64	—	—	—	6,949	2,420	—	—	—	—	—
TOTAL ..	1,011·61	162·41	17	818·05	130·03	—	—	2,910	8,620	12,322	—	3,543	635	1,150	250
Uasin Gishu:															
1st quarter ..	449·94	35·12	5	449·94	34·12	—	1·64	2,700	—	17,800	—	6,501	898	4,796	797
2nd quarter ..	455·29	39·32	6	302·57	29·00	32·00	—	2,943	180,910	1,790	—	10,560	347	7,925	1,769
3rd quarter ..	183·13	9·76	3	7·05	·62	—	1·25	8,341	38,718	—	—	4,580	131	8,870	635
4th quarter ..	371·31	28·13	4	371·31	28·13	41·86	4·79	50,480	34,365	—	—	5,946	747	3,683	898
TOTAL ..	1,459·67	112·33	18	1,130·87	91·87	73·86	7·68	64,464	253,993	19,590	—	27,587	2,123	25,274	4,099

TABLE I—(*Contd.*)

TABLE OF WORK DONE BY THE SOIL CONSERVATION SERVICE DURING THE YEAR 1948—(*Contd.*)

District	Broad Base and V Terracing			S.C.S. Tractors		Narrow Base T.	Bench Ter.	Roads	Excavation C. ft.		Train Banks	Outlet drains		Cut-off drains	
	Acres	Miles	Farms	Acres	Miles	Acres	Acres	Yards	S.C.S. Labour	Farm Labour	Yards	Yards	Cusecs	Yards	Cusecs
Thomson's Falls:															
1st quarter ..	333·97	66·19	7	333·97	66·19	199·10	—	4,037	136,382	10,685	—	1,383	155	1,856	252
2nd quarter ..	640·66	91·22	9	640·66	91·22	22·08	—	1,396	50,899	2,812	—	2,563	?	3,213	?
3rd quarter ..	73·00	8·41	1	73·00	8·41	—	—	—	21,112	—	—	—	—	1,250	204
4th quarter ..	266·00	23·92	6	266·00	23·92	—	—	1,433	26,491	—	817	700	74	4,645	474
TOTAL ..	1,313·63	189·74	23	1,313·63	189·74	221·18	—	6,866	234,884	13,497	817	4,646	229	10,964	930
Trans Nzoia	2,836·19	291·48	39	1,334·25	144·20	—	—	42,769	245,189	213,248	—	32,851	4,439	31,683	3,878
Nakuru	2,859·90	284·20	26	1,961·70	209·80	4·80	40·70	29,505	90,636	24,550	47,590	370	75	27,516	2,948
Nyanza	1,011·61	162·41	17	818·05	130·03	—	—	2,910	8,620	12,322	—	3,543	635	1,150	250
Uasin Gishu	1,459·67	112·33	18	1,130·87	91·87	73·86	7·68	64,464	253,993	19,590	—	27,587	2,123	25,274	4,099
Thomson's Falls ..	1,313·63	189·74	23	1,313·63	189·74	221·18	—	6,866	234,884	13,497	817	4,646	229	10,964	930
TOTALS ..	9,481·00	1,040·16	123	6,558·50	765·64	299·84	48·38	146,514	833,322	283,207	48,407	68,997	7,501	96,587	12,105

GENERAL—

TRANS NZOIA—6,877 yards farm road renovated. 590 acres marked out for contour grass stripping. 338·35 acres set out for future terracing. Diversion ditches, contour furrows, terraces and grass strips set out on 400 acres. Five farm surveys made.

NAKURU—4,816 acres contour ploughing marked out. 1,180 acres strip cropping marked out. 23 acres set out for orchards on 2 farms. One plane table survey of one farm.

NYANZA—15·00 acres=11·80 miles mole drained. 60·31 acres=10 miles mole drainage ditches set out for vlei drainage. 148 auger holes, total depth 1,000·2 ft. bored in low spots in terrace channels to promote drainage. 80 acres set out for contour ploughing and grass stripping. 155·80 acres set out for future terracing. 1,383 boy days levelling meadow strips and planting grass—farm labour. 280 boy days levelling meadow strips and constructing check dams—farm labour.

UASIN GISHU—2,891 acres set out for contour ploughing and grass stripping. 487·67 acres set out for future terracing. 1,914 acres master contoured for wattle. 1,440 acres set out for wattle planting. 3 cut-off drains profiled. 2,183 yards cut-off drains calculated and set out for future construction. 1 irrigation furrow made 300 ft long. 1 irrigation furrow set out 650 ft. long. 1 small dam capacity 1,000,000 gallons constructed. 3,925 ft. road constructed at Soil Conservation Service District Headquarters, Eldoret. 60 tractor hours bulldozing sisal. 747 tractor hours bulldozing anthills. 170 acres=14·84 miles V terraces repeated.

THOMSON'S FALLS—Strip cropping marked out on 9 farms. 110 acres cleared and stumped for terracing. 244 acres survey completed. 500 acres survey nearing completion.

TABLE II

TRACTOR COSTS, 1948

District	Kitale	Kitale	Eldoret	Eldoret	Lumbwa	Njoro	Njoro	Thomson's Falls	Thomson's Falls
Make of Tractor	Caterpillar	International	Caterpillar	Caterpillar	Caterpillar	Caterpillar	Cletrac	Caterpillar	International
Type	D. 6	T.D. 14	D. 6	D. 6	D. 6	D. 4	D.D.	D. 6	T.D. 14
Number	O.H.M.S. 2211	O.H.M.S. 2212	O.H.M.S. 2210	O.H.M.S. 2905	O.H.M.S. 2264	O.H.M.S. 2820	O.H.M.S. 2734	O.H.M.S. 2733	O.H.M.S. 2735
Hours Worked	2,238	1,764	2,280	1.370*	1,335	1,469	1,861	1,937	1,649
Depreciation Charge per hour	Sh. 2/60	Sh. 2/00	Sh. 2/60	Sh. 2/60	Sh. 2/60	Sh. 2/00	Sh. 2/00	Sh. 2/60	Sh. 2/00
Cost of Spares	Sh.6,798/84 Sh. 3/04 p.h.	Sh.13,551/78 Sh. 7/68 p.h.	Sh.6,089/63 Sh. 2/65 p.h.	Sh.4,133/65 Sh. 3/01 p.h.	Sh.7,156/37 Sh. 5/36 p.h.	Sh. 864/69 Sh. 0/58 p.h.	Sh.9,673/02 Sh. 5/19 p.h.	Sh.7,561/12 Sh. 3/90 p.h.	Sh.2,730/95 Sh. 1/66 p.h.
Cost of Repairs	Sh.2,878/00 Sh. 1/29 p.h.	Sh.5,756/00 Sh. 3/26 p.h.	Sh.2,800/00 Sh. 1/22 p.h.	Sh.2,100/00 Sh. 1/53 p.h.	Sh.4,000/00 Sh. 2/99 p.h.	Sh.1,000/00 Sh. 0/68 p.h.	Sh.6,000/00 Sh. 3/22 p h.	Sh.2,000/00 Sh. 1/03 p.h.	Sh.2,000/00 Sh. 1/21 p.h.
Cost of Fuel and Lubrication	Sh.7,082/14 Sh. 3/16 p.h.	Sh.7,307/76 Sh. 4/15 p.h.	Sh.7,630/24 Sh. 3/33 p.h.	Sh.5,888/72 Sh. 4/30 p.h.	Sh.5,822/28 Sh. 4/36 p.h.	Sh.4,390/00 Sh. 2/98 p.h.	Sh.7,339/00 Sh. 3/94 p.h.	Sh.8,978/93 Sh. 4/63 p.h.	Sh.7,660/23 Sh. 4/65 p.h.
Average Cost per hour	Sh. 10/09	Sh. 17/09	Sh. 9/80	Sh. 11/44	Sh. 15/31	Sh. 6/24	Sh. 14/35	Sh. 12/16	Sh. 9/52
Average Cost of Driver	Sh. 2/02	Sh. 2/56	Sh. 1/97	Sh. 2/48	Sh. 3/38	Sh. 3/07	Sh. 2/43	Sh. 2/33	Sh. 2/80
Total Average Cost per hour	Sh. 12/11	Sh. 19/65	Sh. 11/77	Sh. 13/92	Sh. 18/69	Sh. 9/31	Sh. 16/78	Sh. 14/49	Sh. 12/32

*Nine months only, from April–December, inclusive.

DAM TABLE I

DAMS CONSTRUCTED BY THE SOIL CONSERVATION SERVICE DURING 1948

Number of Dam	Waste Spoil Spillway and Entrance	Fill-in Wall	Spillway and Bank	Core Trench Excavation	Total Earth Moved
	Cubic Yards	*Cubic Yards*	*Cubic Yards*	*Cubic Yards*	*Cubic Yards*
48/1	1,730	5,000	2,340	—	9,070
48/2	—	8,441	1,729	498	10,170
48/3	3,220	8,829	391	829	12,440
48/4	4,600	11,300	1,120	237	17,020
48/5	320	11,040	1,945	575	13,305
48/6	1,120	10,240	1,480	386	12,840
48/7	1,510	15,820	250	232	17,580
48/8	720	10,850	—	—	11,450
48/9	—	7,645	—	—	8,465
48/10	2,080	9,369	—	—	12,929
48/11	—	4,760	—	—	5,460
48/12	760	13,232	—	—	14,442
48/13	7,500	32,971	1,500	—	41,971
48/14	3,900	25,619	600	—	30,119
48/15	530	13,286	550	—	14,366
Totals	27,990	188,402	11,905	2,757	231,627

DAM TABLE II

DAMS CONSTRUCTED BY THE SOIL CONSERVATION SERVICE DURING 1948

Owner	No. of Dam	District	Capacity	Catchment Area	Spillway Capacity	Purpose
			Acre ft.		*Cusecs*	
C. H. Ferguson	48/1	Gilgil	25	4 sq. miles	1,500	Cattle.
C. H. Ferguson	48/2	Gilgil	20	4 sq. miles	1,500	Cattle.
C. H. Ferguson	48/3	Gilgil	83	600 acres	500	Cattle.
H. Chart	48/4	Gilgil	115·64	2,000 acres	1,500	Cattle and Irrigation.
R. Bingley	48/5	Gilgil	220·53	700 acres	800	Cattle and Irrigation.
A. Lambie	48/6	Ol' Kalou	44·66	400 acres	500	Cattle.
J. Meiklejohn	48/7	Thomson's Falls	45·27	5 sq. miles	1,500	Cattle.
P. S. van Deventer	48/8	Thomson's Falls	60	5 sq. miles	1,500	Cattle.
J. Meiklejohn	48/9	Thomson's Falls	27·57	649 acres	Natural	Cattle.
W. Edwards	48/10	Thomson's Falls	33	2.7 sq. miles	1,500	Cattle.
W. Edwards	48/11	Thomson's Falls	28	1,200 acres	Natural	Cattle and domestic.
H. Crampton	48/12	Thomson's Falls	40	640 acres	1,000	Cattle.
N. P. Tucker	48/13	Rumuruti	320·5	5 sq. miles	1,750	Cattle.
R. Carr-Hartley	48/14	Rumuruti	205·5	8 sq. miles	2,800	Cattle and Irrigation.
R. Carr-Hartley	48/15	Rumuruti	71	400 acres	450	Cattle.

Total=1,339·67 acre feet=363,865,089·36 gallons.

ANNUAL REPORT OF THE PRINCIPAL, EGERTON SCHOOL OF AGRICULTURE, 1948

Accommodation

European.—The cottages under construction at the end of 1947 as a replacement of the hostel were completed at the end of February, 1948, and the hostel was closed. In all, 15 cottages, a children's dining-room (at the end of the year converted into a staff common-room), two lavatory blocks, one bathroom block and a children's playground were built in little over three months. From 1st March, 1948, the whole school was accommodated in the school grounds.

A cottage was built at "C" Mess for an assistant housekeeper. Improvements were made in "C" Mess kitchen, and various other minor improvements were made to existing accommodation.

At the end of the year, work was begun on converting two of the 15 cottages referred to in the first paragraph of this section into a self-contained staff quarter; this was done by adding a small building between and slightly behind the two cottages, containing kitchen, bathroom and stores. The estimated cost of the finished quarter, comprising two bedrooms, dining-room, living room (with fireplace), kitchen, bathroom and two stores, together with hot water heater, does not exceed £275. All these cottages have been built of cedar uprights and mud and wattle walls, plank floors on piles and cedar shingle roofs. Where kitchens and bathrooms have been installed, the floors are of concrete. Fire-places and chimneys are of stone. If properly maintained they will last 20 years, at least. The cost of a single unit has not exceeded £100.

African.—More huts, bathrooms and latrines were built. The old river camp was at last closed and destroyed. All Africans are now housed in two permanent camps, at school and farm, and one temporary camp, at the quarry. Accommodation should now be adequate. There are six house designs, aimed at showing students what can be done with local materials for different purposes. One design, Mark V, is a very successful semi-detached double cottage with kitchen-living room.

Farm Buildings.—The old milking byre was converted into stables. An incubator house was built. A small bacon and ham curing house and a sheep foot-bath were completed.

Other Buildings.—The metal workshop was extended and an office was added to it for the Engineering Instructor.

Water, Sanitation, Heat, Light and Power

Water.—New and better-sited animal drinking troughs were built on the farm but the completion of the water supply system has been again held up because of the impossibility of buying sufficient piping. The Public Works Department, at my request, to ensure water hygiene, covered the main storage tanks, which they had built. Work was commenced on a storage tank of 10,000 gallons capacity for the irrigation of the new orchard.

Sanitation.—The installation of water-borne sanitation in three staff quarters which do not now possess it was begun but was held up because of the cement shortage.

Light.—Electric light was installed in all rooms in "C" Block and in the milking shed and dairy. The installation in "E" Block was nearly completed.

Training Equipment

Farm.—The development of the school farm as a commercial unit went on (*see* farm section of the report). It now facilitates the demonstration practically of intensive arable dairying in an area which, in dry years, is very nearly marginal

for ley farming. As the land on which the farm is situated is broken, with eroded gullies, and has, over the greater part, a slope, which is nearly the maximum allowable for cereal cultivation, the farm is also a good demonstration of cultivation under difficult conditions. Additional farming equipment was obtained.

Dairy Technology.—Plans were made for the building of a new dairy but construction will not commence until 1949.

Workshop.—Additional tools and equipment were obtained for both metal and wood workshops. These workshops, although not fully equipped, are now sufficiently well stocked to enable tuition to be carried out thoroughly.

Laboratory.—Comparatively little use is made of the laboratory on certificate and refresher courses. Further equipment was obtained during the year. When supplementary orders, to be placed early in 1949, are fulfilled, the laboratory will be adequately equipped for diploma course tuition in the sciences, primary and applied, which underlie farming.

Library.—Further additions were made. There are now over 500 books on technical subjects and Africa and its people and their customs as well as some 500 works of fiction and a large number of bulletins and pamphlets published in England, South Africa, Kenya, the U.S.A. and elsewhere. Subscriptions to suitable periodicals were maintained.

Synopses.—A number of new synopses were written and issued.

Training

Agricultural Certificate Course, 1948.—This was the third of the post-war one-year courses designed primarily for European settlement scheme candidates. It was the first which it was possible to start at exactly the right time of year. The school reached the peak of its student intake at the beginning of this course, there being 86 men in training, 44 students' wives and some two dozen families of children being also in residence.

Because of the termination of the assisted ownership settlement scheme, about eight students had to leave the school before the end of the course to take over farms which they had acquired privately, as and when they could, instead of through the European Settlement Board. Some of these returned later for a refresher course. Some students left early in the course to take up employment other than in farming because they felt that farming was not their bent or because of insufficient capital; one or two were sent down for various reasons. The course ended with 56 students, of whom 11 were Government officers in training, the remainder being tenant farming scheme candidates and private students.

The policy of the school has always been to maintain as high a standard as possible for its courses of instruction and examinations. In pursuance of that policy it was only possible to award passes to just over 50 per cent of the candidates who took the Agricultural Certificate Examination at the end of this course. It is worth noting that of that 50 per cent a greater proportion than ever before obtained passes with distinction or credit.

Students' wives were allowed to take the whole of this course free of tuition fees. To enable those with children below school age to attend it, a European nursery school supervisor was appointed and a small nursery school opened.

One-month Refresher Courses in Mixed Farming.—Two of these courses were held in 1948; one just before the Agricultural Certificate course, in January and February; one at the end of the longer course, in November and December. The average number of students on these courses was 45; students' wives and children were accommodated; their wives were able to attend the course free of tuition fees.

Students included established farmers, European settlement scheme candidates, who were experienced in farming and consequently had not attended any of the Agricultural Certificate courses, and Government officers.

It is intended to run more of these courses, which were very popular, in 1949.

Agricultural Diploma Course.—Preparations were completed for the start of the first of these courses of two years' duration in 1949.

One-month Refresher Courses in Animal Husbandry.—Arrangements were made to hold at least one of these courses in 1949 but it was decided that both of the short courses during this year should be of the mixed farming type.

Special Short Courses in Milking and in Cheese-making.—A number of these special courses were run during the year.

Notes on Candidates.—I would like to draw attention to the paragraph headed "Notes on Candidates" in my 1947 annual report. I am happy to say that there was a distinct improvement in the standard of students, once the genuine farmers were sorted out or sorted themselves out from the remainder. This indicates a decided improvement in selection.

Tuition Methods

No change was made in existing syllabuses. It is noteworthy that the first-year syllabus of the diploma course will be nearly the same as the syllabus of the certificate course because it is felt that students must be taught how to farm before they go on to instruction in the sciences underlying farming.

The underlying rule that in any case not more than 12 students and in many cases not more than six should be taken together for practical instruction was maintained with correspondingly heavy strain on the staff, particularly at the beginning of the course when the number of students was at its greatest.

Tours of farming areas were again conducted both as an extension of training at the school and to acquaint settlement scheme candidates with farms available for them.

Students' Welfare

The system of students' representative committees was again successfully employed. The school for the third year had cricket, hockey and tennis teams. Unfortunately it was not possible to get a Rugby football team together. Dances were held and non-technical cinema film shows were presented at the school weekly by two travelling concerns.

Nursery School

The comparatively large number of students having their wives and children in residence with them made it desirable to appoint a European nursery school supervisor and open a small nursery school in her charge. Children between the ages of two and six years were looked after on weekdays from 9 o'clock until 12.45 p.m.; their mothers were then free to attend lectures and practical work parties. Children under two years of age were regarded as their mothers' responsibility; children over seven years of age went to schools in various parts of the country. At times in the first part of the course as many as 20 children were in the nursery school.

Information Room

Plans have been made for the opening in 1949 of an information room at the school in which will be concentrated a great deal of material related to farming in East Africa and to the school farm. It is hoped that the exhibit will be of interest to students and visitors.

Extension Work

Many visitors were shown round the school and farm. Numerous requests from people outside the school, by letter and verbally, for advice on farming subjects, were dealt with by the staff. The number of students being even greater than in 1947 and in consequence the time of the staff being even more fully filled than before, it was again necessary to postpone putting into effect the proposal to hold organized farmers' days at the school. The School Dairy Technologist undertook a good deal of advisory work in many farming areas.

The school had an exhibit of educational interest at the Country Comes to Town Exhibition in Nairobi.

School Farm

General.—In contrast to the very wet weather of 1947, the year was a dry one with a very cold spell at the time when maize was in growth. From September onwards there was virtually no rainfall adequate for good grass growth. This resulted in a comparatively poor grass and dairying year; maize grain yields were only average. Yields of maize silage, oat hay, oats, barley grain and linseed were, however, the best yet recorded on the farm.

The Arable Rotation and the Products in will result in.—In 1947 a proper balance between ploughed land and grass land was first achieved. Whereas it was not possible to get the whole of the crop rotation into full swing in 1948, some crops being still out of rotation, in 1949 every crop will be in its right place in the rotation.

An extract from the rotation plan is given below:—

Courses.

Key G	1st year	Grass ley.
G	2nd year	Grass ley.
G	3rd year	Grass ley.
GH	4th year	Grass ley ploughed November or ploughed June and immediately followed by oats for smother effect and grazing or hay.
MG	5th year	Grain maize plus phosphates.
CER	6th year	Wheat or oats for grain plus phosphates.
SHLM	7th year	Maize silage and oat hay plus phosphates followed by leguminous green manure or by potatoes with F.Y.M. or by mangolds with F.Y.M.
	or	linseed
	or	mangolds plus F.Y.M.
	or	pulse crops followed by green manure.

Sixty acres each year are in this course, and the apportionment of treatment depends on the requirements at the time. Normally 40 acres would be under silage and hay, and the remaining 20 would be under pulses, mangolds and linseed.

BG	8th year	Barley and phosphates undersown with a grass or sown alone and followed by grass dibbled in under maize silage or lightly sown oats.

An extract of the rotation plan based on these annual treatments is given below.

	FIELDS															
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1949	G	G	GH′	G	G*	G°	BG	BG	SHLM	SHLM	CER	CER	MG′	G	GH′	MG
1950	G	GH	MG	G	G	G	G	G	BG	BG	SHLM	SHLM	CER	GH	MG	CER
1951	GH	MG	CER	GH	G	G	G	G	G	G	BG	BG	SHLM	MG	CER	SHLM
1952	MG	CER	SHLM	MG	GH	GH	G	G	G	G	G	G	BG	CER	SHLM	BG
1953	CER	SHLM	BG	CER	MG	MG	GH	GH	G	G	G	G	G	SHLM	BG	G
1954	SHLM	BG	G	SHLM	CER	CER	MG	MG	GH	GH	G	G	G	BG	G	G
1955	BG	G	G	BG	SHLM	SHLM	CER	CER	MG	MG	GH	GH	G	G	G	G
1956	G	G	G	G	BG	BG	SHLM	SHLM	CER	CER	MG	MG	GH	G	G	GH

The rotation provides, in a normal year, the produce listed below, which is used as shown.

Item	Acreage	Quantity	Use
Maize grain ..	60	750 bags.	Men, cattle, pigs, seed. Reserve 25 per cent. In a good year, surplus to these requirements is for sale.
Barley grain ..	60	600 bags.	Pigs, seed. Reserve 25 per cent. In a good year, surplus to these requirements is for sale.
Wheat	50	450 bags.	Sale. Seed.
Oat grain.. ..	10	100 bags.	Cattle, seed. Reserve 25 per cent.
Ley grass ..	240	—	Cattle. One beast to 1½ acres in rainy season. Sheep followers.
Oat hay	30	90 tons.	Cattle and horses. Seed and reserve under MG.
Maize silage in course SHLM Main Crops	20	240 tons.	Cattle.
	Or apportioned as required		
Linseed	10	—	Linseed sold and cake bought.
Mangolds ..	—	—	Mangolds: cattle.
Pulses in course SHLM as main crops	Apportioned as required or more than 10 if less than 50 required for hay and silage in SHLM.	Variable	Peas, men and pigs.
Oat hay in courses GH and BG ..	Could be 120 additional acres in any one year *if required* but dependent on grass position.	Variable	Cattle and horses.
Green manure Potatoes Mangolds	60	Variable	Potatoes: men and sale. Mangolds: cattle.
As second crop in in course SHLM	Apportioned as required but if potatoes or mangolds, dressed with F.Y.M.		

The cropping plan on this rotation, covering 480 acres approximately, is designed to support 100 head of grade cattle in a balanced herd, keeping on the average 40 head in milk, 30 head of Zebu cattle for breeding and management demonstration, 32 work oxen, 12 to 15 breeding sows and their progeny, and up to 75 men (maize grain only but vegetables are supplied outside the arable rotation and permanent African staff have 1/6 acres gardens). It also supplies 450 bags of wheat for sale annually.

Paddocking.—More fencing was erected round fields and all inter-field tree shelter belts have now been planted. Temporary subdivision of 30-acre fields when under grass has been restricted on account of temporary fencing supply difficulty but experiments were made with electric fencing for this purpose. Some progress was made with water supply to paddocks but work was restricted by lack of piping.

Establishment of Leys.—A strain of star grass has so far proved to be the most reliable grass. *Bromus marginatus* did well in the high rainfall year 1947 but nearly died out in this low rainfall year 1948. Trans Nzoia Rhodes grass has tended to change to the indigenous strain which is fairly persistent. *Bekkeropsis abyssinica* and *Phalaris tuberosa* have been insufficiently resistant to grazing, treading and drought. A number of strains of English and Australian grasses were tried without success. Molasses grass in a small experimental plot was so successful (reaction to grazing not yet known) that 15 acres will be sown with it in 1949 and it is probable that this grass and star grass will be the two mainstays for the next few years.

Pyrethrum.—The maximum acreage under this crop will be 12 acres, some of which was established in 1948, a high toxic strain being planted.

Soil Conservation.—Broad base terraces and "O" roads again stood up well to rainfall but to a lighter rainfall this year, and should, with the maintenance of good heart looked for from the alternate husbandry system adequately protect the soil and the comparatively steep slopes of the farm. Cultivation method was varied as required to maintain terraces and in 1949 the South African method will be employed to "smooth out" cross sections. "Islands" left by the tractor plough will be ploughed by single-furrow ox mouldboard plough to obviate excessive tractor and plough wear and soil disintegration caused by excessive turning.

Crop Production.

Crop	Yield per acre	Total yield
Maize grain	Approx. 9 bags	550 bags
Maize silage	Approx. 12 tons	Approx. 250 tons
Barley glacier	9·8 bags	275 bags
Barley (feeding)	7·2 bags	143 bags
Oat grain	10 bags	150 bags
Oat hay..	3·5 tons	75 tons
Wheat 117A	4·8 bags	117 bags
Linseed	4 bags	20 bags

The year was a good one for maize silage, oat hay, oat grain, barley grain and linseed. The barley and oat hay yields were the best so far obtained. Despite the earliest possible planting, maize yields were depressed by the cold "winter" season. The farm is marginal for grain maize but it must be remembered that in 1947, when conditions were just suitable, 15 bags to the acre were obtained.

The 117A wheat should have done better but it is regretted that owing to a tractor breakdown the wheat was late sown and just missed the best of the July rains at the right point in the growing period. Tractor breakdown is sometimes more frequent than is normally the case because more than 200 students have been taught driving on the farm tractors.

Glacier barley, grown on a field scale for the first time, was a great success and is the strongest strawed variety I have yet had. It withstood well the July/August rains in which most barleys lodge on this exposed ridge. The low and badly distributed rainfall resulted in a poor grass growth over most of the year.

The Grade Dairy Herd.—The policy outlined in my 1947 annual report was continued. The herd as mentioned above is now kept at 130 (including Zebu), a reduction of 14 head in comparison with 1947. The small bullock fattening herd of 15 kept in the wet season of 1947 has been abandoned and all bull calves are now being sold for veal or killed at birth. The farm will, in 1949, be carrying the maximum head of cattle which it should carry.

The average lactation (305 days) in 1948 of the grade herd including first calvers was 531.92 gallons. Considering the poor grass growth in the year, this was good.

Other statistics are:—

Average number of cows in milk: 40.
Total production of milk: 25,462 gallons.
Highest daily average (11th May, 1948): 24.2 lb.
Herd daily average per cow for whole year: 17.44 lb.
Butterfat average: 4 per cent.
Milk sold as whole milk: 11,256 gallons.
Milk sold as cheese: 515 gallons.
Milk sold as butter: 11,193 gallons.
Milk sold as butterfat: 550 lb.

The school was awarded third prize in the milking trial at the Royal Agricultural Society's show held at Nakuru in June, 1948. A demand has begun for the school's cattle for breeding purposes.

Pigs.—The demand for the school's own strain of pure-bred Large White pigs for breeding purposes was maintained. Some of the sows imported by the Pig Industry Board and now at the school were very disappointing both as breeders and as rapid weight-gainers and will be culled early in 1949.

Earliness of maturity was not achieved so successfully in 1948 as in 1947 because of the shortage of protein feeds in the early part of the year. This was remedied towards the end of the year; the food position for 1949 should be good. The difference in the effect of the protein shortage on the school's strain of pigs and on the importations was marked; whereas both suffered, the school strain progeny did not suffer so markedly as did the progeny of the importations. Although rather too many breeding sows were kept in 1948, the farm would not have been really overstocked but for the effect of delay in maturity particularly of the progeny of the importations; this delay resulted in temporary overstocking in the latter half of the year. The farm will carry in 1949 a reduced maximum of 15 breeding sows, of which eight will be sows of the school's own strain. That reduction, together with the good food position, should result in a return to really early maturity.

The statistics given below of sales in 1948 well illustrate the marked superiority of the school's strain, both in maturity and fertility. Both strains were reared under the same conditions:—

	School Strain of Large White	Importations by Pig Industry Board
Number of breeding sows	10·17*	9
Sales:—Baconers	85	28
Porkers	21	8
Larders	4	1
Breeding Stock	54	15
Weaners	18	—
TOTAL	182	52

The introduction of the variety of barley "Glacier" referred to earlier in this report will have a beneficial effect on the pig rationing. The crop harvested was, I believe, the only one in the country in 1948. Glacier gave a good yield of a good feed grain and was easily the strongest strawed variety yet grown. That is an important point on this exposed land. It was disappointing that the germination percentage was below average.

Poultry.—The year was a disappointing one for poultry; the improved production hoped for not being achieved. Whereas it is the policy to retain a poultry section at the school, poultry-keeping is not regarded as an essential part of mixed farming. In 1948 particularly the need was felt for a poultry instructor. The section was in charge of a member of the staff who had many other duties in a year in which the school had its greatest number of students and their families in residence. Under these circumstances it was impossible to do more than maintain this section without enlarging it.

Romney Marsh Sheep.—A great improvement occurred in the sheep in 1948. Health generally was good, there being very little footrot in comparison with its incidence in the wetter year 1947. Sales of wethers were satisfactory. The school gained a first prize at the Royal Agricultural Society's show held at Nakuru in June.

Vegetables.—An increase in production occurred and plans have been made for a further increase in 1949, now that some irrigation can be done.

Fruit.—The orchard was bench-terraced and more than half of it planted with several kinds of deciduous fruits. The remainder will be planted in 1949. In future years it should become a useful aid to horticultural instruction.

Labour.—The policy noted in my 1947 annual report was continued. The school for African children was opened. Excellent work was done by the African staff in 1948; this should be recorded.

Accounts.—Cost of production remained approximately as reported in 1947 with the exception that the costs of production of baconers inevitably rose on account of lateness in maturity. The gross revenue for the farm was £4,341, a record. The approximate net profit of £1,521 (after allowing for a rent charge of 4½ per cent on landlord's capital) represented a return of 26 per cent on the tenant's capital of £6,145 and approximately of 9 per cent on the total capitalization of the farm which is valued at £16,845. The profit and loss account and balance sheet are attached as an appendix.

The estimated gross revenue for 1949 is £4,700.

Revenue and Expenditure

Revenue.

	£
Revenue from school fees (excluding rent charges and bursaries)	10,900
Revenue from farm	4,341
Total Revenue	£15,241

Board and Lodging Expenditure

Recurrent board and lodging expenditure represented a saving of approximately 16 per cent of the funds allocated for the year. This is accounted for by the reduction in number in residence in the latter half of the year but it must also be remembered that costs again rose, that overheads do not decrease in the same ratio as food costs when the number in residence decreases, and that *two* short courses were run in the year whereas only one was budgeted for

Subsidy

Taking into account all revenue and savings on expenditure, the school was subsidized by about £9,000 in 1948. This subsidy should be substantially reduced in 1949 when the fees will be increased to a scale commensurate with present-day costs. In 1948 students were only charged £14 per month, inclusive.

Future Policy

In pursuance of the policy decided upon, plans were made for the commencement of the first diploma course in 1949, for the continuation of the mixed farming refresher course and for the introduction of an animal husbandry refresher course. The 1949 certificate course may be the last of its kind.

J. E. P. BOOTH,
Principal.

APPENDIX

Copy of Profit and Loss Account for the Year Ended 31st December, 1948

Date		Debit		Date		Credit	
1948		*Folio*	*Sh.* *cts.*	1948		*Folio*	*Sh.* *cts.*
31st Dec.	Bad debts	B10/1	6 00	31st Dec.	Dairy	D1/8	12,378 88
	Fruit	F1/1	393 26		Flax 1947	F2C/1	878 25
	Potatoes	P8/1	142 90		Pigs	P5/3	9,862 37
	Net profit carried to capital account	C6/1	30,423 15		Poultry	P6/3	539 75
					Sheep	S2/1	331 10
					Vegetables	V1/1	1,176 43
					Wheat 1947	W2/1	5,798 53
		Sh.	30,965 31			*Sh.*	30,965 31

Copy of Balance Sheet on 31st December, 1948

Liabilities	*Sh.*	*cts.*	Assets	*Sh.*	*cts.*
Tenant's capital	122,901	37	Cash	22,421	50
Sundry Creditors	2,241	99	Crops:		
			Barley 1948	3,676	22
			Oat hay 1948	2,512	78
			Linseed 1948	458	32
			Maize 1948	4,631	64
			Mangolds 1948–49	433	83
			Oats 1948	2,849	41
			Peas 1948	271	56
			Maize silage 1948	2,725	14
			Wheat 1948	2,259	96
			Fruit	1,500	00
			Pyrethrum	240	54
			Trees	349	60
			F.Y.M. 1948	165	00
			Livestock:		
			Dairy herd	39,865	00
			Pigs	13,100	00
			Poultry	3,152	00
			Sheep	2,575	00
			Work oxen	2,800	00
			Tractors	3,753	00
			Machinery, Tools and Implements	10,258	00
			Sundry debtors	5,147	86
	125,143	36		125,143	36

ANNUAL REPORT OF THE CHIEF GRADER AND INSPECTOR, 1948

Staff

Miss H. Marsden, Clerk, resigned from the permanent staff on the occasion of her marriage in May, and left Government service at the end of the year.

Mrs. J. Pollitt, Clerk, temporary, joined the department on 1st December.

Mr. A. E. Taylor, Acting Superintendent, Maize Conditioning Plant and Cool Stores, was promoted Superintendent, Maize Conditioning Plant and Cool Stores as from 1st February.

Inspection

Exports.—Forty-nine Phytopathological Certificates were issued as under:—

One for 401 bags Uganda chillies for Colombo.
One for 474 bags Uganda chillies for Alexandria.
Five for 1,285 bags Congo coffee for U.S.A.
Twenty-five for 8,284 bags Uganda coffee for E. Mediterranean Ports.
Eleven for 28,693 bags Kenya millet for Bombay.
One for 1 sample Uganda millet for Colombo.
Two for 3,161 bags sunflower seeds for U.K.
Two for 7,171 bags maize for Haifa.
One for 4 bags fibre samples for U.K.

The great demand for certificates for coffee is due to the action of the Egyptian Government, who now demand certificates even for coffee being transhipped at Port Said.

The certificates for maize were for transhipment cargo from Portuguese East Africa, which was landed at Kilindini, cleaned and re-exported.

Imports.—

Commodity	No. of Packages	Declared Value
		Sh.
Seeds	2,073	220,190
Tea seed	5	1,000
Plants	33	3,642
S.A. fruit	15,161	192,229
S.A. apples	9,531	247,746
Australian apples	4,221	101,670
E.A. fruit	20,218	138,484
Fruit trees	426	71,640
Drugs	961	84,147
Food and spices	76,185	3,617,794
Ground-nuts	16,538	799,908
Total Kenya	145,352	5,479,450
Uganda	732	46,361
Tanganyika	700	51,611
Belgian Congo	34	5,700
Refused entry	62	1,031
Grand Total Inspected	146,880	5,584,153

The total number of packages is the highest recorded since 1944, when the total was greatly increased by the importation of large quantities of foodstuffs that year. The main increases over the previous year were in East African fruit, ground-nuts, foods and spices. There was a slight fall in the quantity and value of seeds, but the increased importation of fruit trees since the war continues. Three hundred and forty-one bundles valued at £2,726 arrived in three weeks during the latter half of July and the beginning of August. No South African

fruit has been rejected for the last two years. The Australian fruit was almost a complete loss, as it arrived frozen; otherwise it was very good fruit but commercially useless. The commodities refused entry were almost entirely plants and bulbs.

Grading

Maize.—The season opened in January with small consignments being submitted for grading direct, but these soon came to an end due to weevil infestation, and subsequent arrivals were switched to the Conditioning Plant for treatment before grading. During March and April the majority of the maize was treated at the Conditioning Plant in Nairobi before being railed to the coast. By May the quality had deteriorated to such an extent that it was not possible to include it even in undergrade (K8), on account of the weevil damage having risen to between 40 per cent and 50 per cent.

Grading Direct.—One truck of second-grade flat white maize (K2) was received from Kampi-ya-Moto and just over two trucks of flat yellow (K4) from Solai. The balance of the yellow maize was graded undergrade yellow on account of the presence of weevils (K8YSW), there being no other slightly weevily grades for yellow maize.

Grading After Conditioning:—

At Kilindini.—The treatment of weevily maize for export came to an end in March during which period 11,847 bags were graded after treatment undergrade conditioned (K8C).

At Nairobi.—Between January and April, 46,692 bags were received for grading after treatment in the Nairobi plant, and were graded undergrade conditioned (K8C). During May a further 15,773 bags were received. These had been stored after treatment and had become re-infested with weevils, and so had to be rejected.

The following table shows how the maize from various sources was classified; 1947 totals are shown for comparison:—

	Direct	M.C.P. Kilindini	G.C.P. Nairobi	Total 1948	1948
K2	310	—	—	310	1,497
K3	—	—	—	—	2,591
K3SW	—	—	—	—	40,355
K3 C.	—	—	—	—	3,625
K4	672	—	—	672	509
K8 W.	—	—	—	—	44,677
K8 Y	—	—	—	—	917
K8W. SW.	—	—	—	—	2,185
K8YSW	309	—	—	309	300
K8C.	—	11,847	46,692	58,539	557,076
K8Y.	—	—	—	—	4,524
Cusco.	—	—	—	—	5,488
Total Graded	1,291	11,847	46,692	59,830	683,741
WET	—	—	1,161	1,161	11,139
WL.	39	—	—	39	20,324
RJ	—		15,773	15,773	1,976
Total Rejected	39	—	16,934	16,973	33,439
Total Received	1,330	11,847	63,626	76,803	717,180

Shipments under Certificate.—Shipments continued from the previous year, and went on until April. There was one large shipment of undergrade maize to Egypt, and several smaller ones to Southern Rhodesia.

The following table shows the certificates issued:—

Two for 8,828 bags K3 SW.
Five for 40,189 bags K8 C.
One for 76,644 bags K8 C. Bulk.
One for 310 bags K3.
Seven hundred and twenty-four bags K3 SW.
Six hundred and seventy-two bags K4.
Three hundred and nine bags K8 Y. SW.
Eight hundred and ninety-nine bags K8 C.

Nine certificates, 128,575 bags.

In addition to the foregoing a certificate of inspection was issued for 15,773 bags of maize which it was impossible to grade, but the export of which was permitted by rule 12. This was the maize which had been conditioned in Nairobi and subsequently had become reinfested with weevils. It was a case when something had to be done in a hurry. There were 109 railway units under load, and the port had nowhere to store the maize nor was there any other storage space available in Mombasa if it were decided to treat it at the conditioning plant at Kilindini. On the other hand there was a ship available to take it, if its export could be permitted. In order to assist the Railway Administration, who were extremely seriously inconvenienced by being left with this amount of rolling stock, which they could not off-load, it was decided to permit its export as stated above.

Shipments under Rule 25.—Shipments of ungraded maize to local ports began in April, and continued with fluctuations till the end of the year.

The following table shows the quantities and destinations:—

122,573 bags to Dar es Salaam.
9,640 bags to Seychelles.
2,505 bags to Zanzibar.

Total 134,718 bags.

Commercial Beans—Grading.—At the beginning of the year about 730 tons of White Haricot beans of the previous year's crop came on to the market. The majority of these were graded Undergrade (K5) on account of beetle damage. From August to November the East African Cereals Pool exported about 700 tons of soya beans. In general the quality was fairly good, and lay between a Second and Third Grade (K2 and K3). From September to the end of the year there were small exports of White Haricot beans and one of Canadian Wonder beans grown in the Arusha district.

The following table shows the quantities and grades of the different varieties:—

Variety	K2	K3	K5	Total Received
				bags
Soya beans ..	3,196	4,740	—	7,936
White Haricot ..	288	1,737	7,025	9,050
Canadian Wonder	110	—	—	110
	3,594	6,477	7,025	7,096

Shipments.—The following certificates were issued:—

1 for 3,196 bags K2 Soya beans.
3 for 4,740 bags K3 Soya beans.
2 for 2,272 bags K3 White Haricot.
1 for 7,761 bags K5 White Haricot.

There were no local shipments under Rule 15.

Seed Beans—Grading.—Requests to grade Tanganyika seed beans were far more frequent. Some growers prefer to sell on Government grades, while others still prefer to sell on sample and their own reputation. The season was a far bigger one than usual, but the quality on the whole was probably lower. It seems to be uneconomical to try to produce a really even, homogenous sample of certain dwarf bean varieties. Those known as The Prince, Long Tom and Masterpiece appear extremely prone to discoloration, and for this reason were not fit to be graded higher than a second or even a third grade. Beetle damage was very well controlled and no case for degrading for this cause was found. Almost all consignments had been treated with some form of gammexane dust, by the grower.

The following table shows the quantities and grades:—

K1	2,290 bags
K2	2,716 bags
K3	380 bags

Some exporters required certificates of germination to cover their consignments to Australia. Six consignments were tested; the results ranged from 98 per cent to 99.4 per cent germination, the mean was 98.7 per cent.

Shipments.—

29 certificates were issued in respect of 1,731 bags K1.
26 certificates were issued in respect of 1,183 bags K2.
2 certificates were issued in respect of 142 bags K3.

In addition 100 certificates of examination and fumigation were issued in respect of 10,238 bags of ungraded seed beans.

Potatoes—Grading.—Owing to the local shortage of potatoes, none were available for export until the end of June. Exports began in July, but were confined mainly to coastal ports. The first export licences granted for other ports were for seed potatoes, but as the majority of the potatoes produced for export are grown by Africans and are of many unnamed varieties, apart from their not being strictly seed potatoes, nor complying with the description in the grading regulations, none of these potatoes were graded as seed. On account of the large percentage of small, mechanically damaged and rotten potatoes they could not be graded Second Grade (K2) either. When unrestricted export licences were issued, after fairly extensive sorting fair samples of second grade potatoes were produced.

From August to September the majority of the potatoes presented for grading came from Elburgon. They consisted of two types, the one round, the other sausage shaped. The latter is known to have a poor keeping quality. Later sorting at Elburgon improved temporarily, but showed a distinct falling off towards the end of the year.

In November it was decided at a conference in Nairobi to limit the export of potatoes to ports other than local coastal ports to first grade potatoes (K1) in crates. Many consignments towards the end of the year, though crated, contained too many undersized potatoes to be graded First Grade (K1). They were exported as Second Grade (K2).

The following table shows the grades of the potatoes received for grading:—

K1	697 cwt.
K2	17,358 cwt.
Seed	—
Total graded	18,055 cwt.
Rejected	2,306 cwt.
Total received	20,361 cwt.

Shipments.—

Aden	400 cwt.	
Bombay ..	1,257 cwt.	
Dar es Salaam	3,320 cwt.	
Mauritius ..	6,945 cwt.	
Mogadishu ..	145 cwt.	
Seychelles ..	1,179 cwt.	
Zanzibar ..	4,709 cwt.	
	100 cwt.	graded but not shipped.
Total ..	18,055 cwt.	

There were only three main overseas shipments, one to Bombay and two to Mauritius.

Ships' Stores.—Potatoes were released for ships' stores in March, as local supplies were becoming more plentiful by then, and were supplied for the rest of the year.

Three thousand five hundred and sixty bags, equivalent to 5,630 cwt. were exported as ships' stores.

Wheat—Grading.—A small consignment arrived in January, and a further consignment in April. A larger consignment started in July and continued till the end of September. Of that received in July, more than half was wet, some of it very wet. It was then decided to dry all the wheat at the conditioning plant in Nairobi subsequent to its being treated for the extraction of datura seed there. In November the final consignment of the year began to arrive. The majority of this was wet, and was consigned direct to the conditioning plant at Kilindini. After the April consignment nothing but first grade (K1) wheat was received.

The following table shows the quantities received and the grades into which they were classified:—

	Graded Direct	After Treatment at the M.C.P. Kilindini	Total
			bags
K1	37,483	20,576	58,059
K2	4,136	—	4,136
Total Graded	41,619	20,576	62,195
Wet	10,055	—	10,055
Total Rejected	10,055	—	10,055
Total Received	51,674	20,576	72,250

As the majority of this wheat was treated either in the conditioning plant at Nairobi or Kilindini, weevils were eliminated, which accounts for the complete absence of slightly weevily grades and rejections as weevily.

Shipments.—Five certificates were issued to cover exportations of 55,183 bags First Grade (K1) to India.

No shipments to coastal ports under rule 22 were recorded.

Conditioning

Maize Conditioning Plant, Kilindini.—The heavy conditioning programme of the previous year continued into January, with both plants working 24-hour shifts. As the quantities waiting to be treated became smaller, the small (No. 2) plant continued working on maize while the large (No. 1) plant worked on beans and cow peas. On the 23rd of January, this shipment of maize was completed, and the small plant was closed down, and has not been operated again since then. Apart from a consignment of wet Uganda maize and the wheat already referred to under Grading of Wheat, all the work at the plant has been confined to small consignments, and the work has mostly been done by day shifts. Also, apart from these consignments of maize and wheat, all the rest of the grain treated was for the destruction of storage pests. One type of grain worthy of mention was a consignment of about 100 tons of millet, which was cleaned, and with which the plant dealt much more successfully than was anticipated. Though this grain had been stored for some considerable time the treated sample, when the dirt and defectives had been removed, had a very pleasing appearance.

The following table shows the quantities of the various types of grain treated. 1947 figures are shown for comparison:—

	1948	1947
	bags	bags
Maize	35,825	353,157
Beans	20,674	20,399
Cow beans	6,024	6,762
Wheat	25,039	30,079
Moong	1,383	128
Millet	1,043	—
Rice	2,558	—
Peas	822	—
Gram	140	—
Njahi beans	120	—
Sorghum	—	2,638
	93,628	413,163

Working Times.—

	Part Shifts Total in hours	12-hour shifts	24-hour shifts	Total hours less time lost
No. 1 plant ..	233	42	34	1,530½
No. 2 plant ..	12	6	6	225

Heat Treatment.—93,422 bags were treated in the heat treatment chamber for the destruction of grain storage pests. The figure of bags treated does not agree with the total for conditioning as some of the produce, principally rice, millet and cow peas, was not delivered to the plant in 200 lb. bags.

Grain Conditioning Plant, Nairobi.—The produce treated in this plant during 1948 was all on the account of the Maize and Produce Control. During the absence of the Superintendent, who was away sick from 14th February to the beginning of October the plant was taken over and run by the Maize and Produce Control.

From the beginning of the year to the end of March the plant was fully engaged; then work was reduced to two shifts per day until the 24th July, from which date three shifts were worked till the plant closed down at 4 p.m. on 24th December.

The following grain was received for treatment:—

	1948	*1947*
Maize	307,168 bags	383,600 bags
Wheat	41,829 bags	—
Moong	14,373 bags	—
Totals ..	363,370 bags	383,600 bags

Actual working time, 5,735½ hours.

General.—The treatment of 63 bags per hour at the Nairobi plant is a very satisfactory figure. The corresponding figures for the Kilindini plants are No. 1 Plant, 57.6 bags per hour, and No. 2 Plant, 24 bags per hour. Although the capacity of the No. 1 Plant at Kilindini is the same as the Nairobi plant, the former was not working as continuously as the latter, and the time taken to fill and empty the plant and the time taken in cleaning the plant when changing from one commodity to another increased the working time without increasing the out-turn. The actual out-turn figures for the two plants were Nairobi, 60.5 bags per hour, and Kilindini, 55.2 bags per hour.

Fumigation

Twenty-two thousand two hundred and twelve bags of produce were treated in 139 operations, details of which are shown below, and compared with the totals for 1947:—

	1948	*1947*
Seed beans ..	20,970 bags in 127 operations	10,007.64
Other produce ..	1,242 bags in 12 operations	3,947.33
Commercial beans	—	975.06

Carbon bisulphide was used as the fumigant, until supplies were exhausted, where carbon-tetrachloride ethylene-dichloride was used. The new season crop of seed beans started to arrive at the end of August, and from the 13th of September to the end of the month both chambers were almost continuously occupied. During October, November and December they were continuously filled to capacity, during which period 17,340 bags of seed beans were treated in 92 operations. The other produce treated consisted mainly of seed peas and lettuce seed almost entirely from the Northern Province of Tanganyika Territory.

Cool Stores

The following table shows the quantities of the various commodities deposited in the cool store during the year, and the revenue earned by them:—

	Deposits	Revenue	
	lb.	*Sh.*	*cts.*
Mutton and lamb	60,673	3,854	88
Beef and veal	440,986	22,972	01
Pork	171,866	5,033	77
Offal	90,948	4,110	61
Bacon and ham	173,673	6,296	72
Cheese	53,517	2,212	32
Fresh fruit	109,506	4,147	56
Poultry	1,078	3,596	75
Fresh fish	41,465	2,502	53
Cured fish	65,482	3,434	60
Eggs	39 c/s	46	00
Miscellaneous	11,862 lb.	824	82
Local butter	4,284 c/s	4,373	44
Butter store	34,276 c/s	20,265	00
	3,560,671 lb.	83,671	01

Average space occupied—General Store 67·65 per cent.
Butter Store 44·3 per cent.

The total weight of produce stored shows a fall of 5.7 per cent on the previous year, which in view of the reduction of almost 25 per cent of the butter deposited in the butter store shows a great increase in other commodities. Meat, mainly beef, shows an increase of 12.6 per cent; fish, though fresh fish is down, shows a total increase of nearly 50 per cent; fruit, now that there is space for it again, presents a considerable total.

In view of the fact that the space occupied in the general store has risen from 58.3 per cent to 67.65 per cent, it is not surprising that revenue has risen as well.

The increases in space occupied and in deposits of meat are accounted for to some extent by large consignments of imported meat held in the cool store by the military, who were unwilling to store it in their own cool store.

As it has been anticipated that the cool store would close down when the Port Terminal cool store, operated by the Railway, came into commission, and as the first completion date for that store was originally some time in 1946, the minimum of spares and replacements have been ordered for the Department cool store. Great credit is due therefore to the Superintendent, and his staff, in maintaining the efficiency of the plant, especially as the whole load was carried by the Peter Brotherhood compressors, running one at a time, which are now 21 years old.

Finance

The year was not as successful financially, as the previous year owing to a great reduction in the flow of exports. Apart from the cool stores and the conditioning plant at Nairobi, every branch of the service records a loss. The profit on the Nairobi plant (Appendix D), shows the economy in running prolonged continuous shifts, as opposed to the loss on the Kilindini Plant (Appendix C), which was continually starting up and stopping, whilst treating small consignments. The profit on the Nairobi plant would have been greater, but no revenue was received whilst the plant was operated by the Maize and Produce Control treating their own produce.

Acknowledgments

I would like to record the thanks of this section of the Department to the Port Administration, the Traffic Section of the E.A.R. & H., the Kenya Landing & Shipping Co., Ltd., and the staff of the Parcels Office at the G.P.O. Mombasa, for their continued assistance and co-operation.

P. M. QUIGGIN,
Chief Grader and Inspector.

APPENDIX A

GRADING

Expenditure			Revenue			
	Sh. *cts.*	*Sh.* *cts.*				*Sh.* *cts.*
Salaries—			Grading—			
Graders and Inspectors	14,841 16		Maize	1,330 bags	@ 5 cts. ..	66 50
Clerks	2,816 73		Maize	75,473 bags	@ 3 cts. ..	2,264 19
African Staff	2,473 50		Beans	23,067 bags	@ 5 cts. ..	1,153 35
			Potatoes	20,361 cwt.	@ 10 cts. ..	2,036 10
Sundry Expenses—		20,131 39	Wheat	72,250 bags	@ 6 cts. ..	4,335 00
Grading	1,469 31		Moisture Tests	2	@ 5/–	10 00
Fumigation	1,337 48		Germination Tests	6	@ 10/–	60 00
Casual Labour—Fumigation	1,686 19		Fumigation	139 Operations		
		4,492 98			@ 20/–	2,780 00
Local Transport and Travelling	733 31		Expenses of Additional Handling Recovered ..			218 56
		733 31	Balance being excess of Expenditure over Revenue			12,433 98
	Sh.	25,357 68			*Sh.*	25,357 68

APPENDIX B

Plant Inspection

Expenditure			Revenue	
	Sh. *cts.*	*Sh.* *cts.*		*Sh.* *cts.*
Salaries—			Phytopathological Certificates	500 00
Graders and Inspectors	10,022 72			
Clerical Staff	1,314 07			
African Staff	248 87			
		11,585 66		
Travelling		1,036 95	Balance being excess of Expenditure over Revenue	12,122 61
	Sh.	12,622 61	*Sh.*	12,622 61

APPENDIX C

CONDITIONING—KILINDINI

Expenditure	Sh. cts.	Sh. cts.
Salaries—		
Graders and Inspectors	4,185 66	
Superintendent and Foreman ..	20,724 12	
Asian Mechanic	6,863 68	
Clerical Staff	1,816 74	
African Staff	6,742 69	
Overtime Mechanic	746 42	
Overtime African Staff	1,000 82	
		43,080 13
Travelling		1,314 20
Sundry Expenses—		
Casual Labour (Plant)	14,556 33	
Casual Labour (Heat Treatment) ..	1,893 55	
Power	2,621 26	
Water	1,426 00	
Fuel	19,294 39	
Sundries	7,771 02	
		47,562 55
	Sh.	91,956 88

Revenue	Sh. cts.	Sh. cts.
Conditioning—		
Maize 35,825 bags @ 60 cts...	21,495 00	
Beans 20,674 bags @ 70 cts...	14,471 80	
Cow peas 6,024 bags @ 60 cts...	3,614 40	
Peas 822 bags @ 60 cts...	493 20	
Millet 1,043 bags @ 60 cts...	625 80	
Moong 1,383 bags @ 60 cts...	829 80	
Gram 260 bags @ 60 cts...	156 00	
Rice 2,558 bags @ 60 cts...	1,534 80	
Wheat 25,039 bags @ 60 cts...	15,023 40	
		58,244 20
93,628		
Heat Treatment—		
93,628 bags @ 5 cts...		4,671 10
Balance being Excess of Expenditure over Revenue		29,041 58
	Sh.	91,956 88

APPENDIX D

CONDITIONING—NAIROBI

Expenditure			Revenue	
	Sh. *cts.*	*Sh.* *cts.*		*Sh.* *cts.*
Salaries	48,540 08		189,188 bags @ 70 cts.	132,431 60
Power	5,614 70			
Labour and Sundries	13,083 57			
Water	858 00			
Fuel	20,225 64			
		89,041 99		
Travelling		1,954 60		
Balance being Excess of Revenue over Expenditure ..		41,435 01		
	Sh.	132,431 60	*Sh.*	132,431 60

APPENDIX E

Cool Stores

Expenditure			Revenue		
	Sh. *cts.*	*Sh.* *cts.*		*Sh.* *cts.*	*Sh.* *cts.*
Salaries—					
Manager	4,223 75		Storage Charges ..		63,671 01
Superintendent	18,687 44		Rent of Butter Store	20,000 00	
Clerks	4,976 43		*Less* Rent of Godown	2,400 00	
Mechanic (Asian)	9,599 51				17,600 00
African Staff	7,338 07				
Overtime	7,451 20				
		55,579 21			
Travelling		1,568 55			
Sundries—					
Power	13,726 70				
Water	513 75				
Ammonia	1,211 45				
Sundries	1,694 35				
		17,146 25			
Balance being Excess of Revenue over Expenditure		6,977 00			
	Sh.	81,271 01		*Sh.*	81,271 01

APPENDIX F

REVENUE AND EXPENDITURE SUMMARY, 1948

Service	Expenditure	Revenue	Profit	Loss
	Sh. cts.	*Sh. cts.*	*Sh. cts.*	*Sh. cts.*
Grading	25,357 68	12,932 70	—	12,433 98
Plant Inspection	12,622 61	500 00	—	12,122 61
Conditioning, Kilindini	91,956 88	62,915 30	—	29,041 58
Conditioning, Nairobi	90,996 59	132,431 60	41,435 01	—
Cool Stores	74,294 01	81,271 01	6,977 00	—
Sh.	295,227 77	290,041 61	48,412 01	53,598 17

Net Loss: Sh. 5,186 16 cts.

APPENDIX G

Statement of Balances as at 31st December, 1948

Grading and Conditioning Combined

	Sh. *cts.*	*Sh.* *cts.*
Combined Credit balance as at 31–12–47	13,963 47	
Profit on Conditioning at Nairobi	41,435 01	
		55,398 48
Less Loss on Grading	12,433 98	
Loss on Conditioning at Kilindini	29,041 58	
	41,475 56	
Combined Credit balance as at 31–12–48	13,922 92	
	55,398 48	55,398 48